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B-1 AIRCRAFT MAIN HYDRAULIC PUMP TESTS WITH MIL-H-87257 HYDRAULIC FLUID



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In an effort to convert the B-1 a	ircraft from MIL-H-5606 to th	e fire resistant MIL-H-87257 h	ydraulic fluid, the Air Force		
sponsored a study conducted by		-			
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Laboratory (AFRL/MLBT) und			•		
base line test was conducted usi	_		_		
Both pump tests were successful. Based on these tests MIL-H-87257 was deemed suitable for use in B-1 aircraft. The results of the pump tests are the subject of this report.					
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1.0 INTRODUCTION

MIL-H-83282 is a synthetic, less flammable hydraulic fluid that replaced the flammable MIL-H-5606 hydraulic fluid in most Air Force aircraft. MIL-H-83282 does not meet the viscosity requirements for -65 •F operation. However, MIL-H-87257, the low temperature version of MIL-H-83282 fluid, does meet these requirements.

In an effort to convert the B-1 aircraft from MIL-H-5606 to MIL-H-87257, the Air Force sponsored a study conducted by Rockwell International from April 1991 through June 1992, under contract F34601-89-C-0401. The results of this study are published in Rockwell Report NA-91-1598, dated 17 June 1992. As part of this study, two pump tests were conducted by Vickers using B-1 aircraft hydraulic pumps (Vickers PV3-300-7B) and MIL-H-87257 (ROYCO 777) hydraulic fluid. During the first test, the pump failed prematurely. The second test was stopped before the scheduled test duration because some metal was observed in the filter patch-test. Due to lack of funding no additional pump tests were carried out to check the compatibility of MIL-H-87257 and B-1 hydraulic pumps. This being the only unresolved issue standing in the way of transitioning this fluid to the B-1 aircraft, the Nonstructural Materials Branch of the Materials Directorate of Wright Laboratory (WL/MLBT) decided to conduct in-house pump tests with MIL-H-87257 and B-1 hydraulic pumps to provide the necessary data. The results of the two pump tests carried out at WL/MLBT are the subject of this report.

2.0 TEST OBJECTIVE

The objective of this program was to complete the initial studies begun by Rockwell to determine the compatibility of MIL-H-87257 with the B-1 hydraulic pumps.

3.0 PUMP TESTS

The Vickers PV3-300-7B hydraulic pump is a constant pressure, variable displacement pump capable of very high flow rates of up to 64 gpm and requiring high horsepower input. Due to the horsepower limitations of the WL/MLBT hydraulic pump test stand, it was not practical to duplicate either the qualifying tests or the tests conducted at Vickers. After reviewing the test conditions and the pump failure modes generated at Vickers during the hydraulic pump testing of MIL-H-87257 hydraulic fluid, the following plan was agreed upon by all the interested organizations.

3.1 PUMP TEST PLAN

Hydraulic Pump: Vickers Model PV3-300-7B Pump (new pump for each test).

Test Fluids: MIL-H-5606F, Baseline, WL/MLBT Pump Test 33

MIL-H-87257 (ROYCO 777), WL/MLBT Pump Test 34

Test Duration: Total 90 hours.

STAGE I: 30 hours STAGE II: 30 hours

STAGE III: 30 hours

Pump Inlet Pressure: 95-100 psig.

Pump Outlet Pressure: 4150 psig. Pump Outlet Flow: 50 gpm.

Pump Shaft Speed: 5250 rpm.

Pump Inlet Temperature:

STAGE I:

180 °F

STAGE II: STAGE III: 210 °F 250 °F

Filter Elements:

Main Filter - Pall Corporation, P/N AC-9516F-1,

3 micron, replaced after each test

Heat Exchanger Bypass Filter - Pall Corporation

P/N AC-7031F-1297Y6, 5 micron, replaced after each test

Case Drain Filter - Pall Corporation P/N AC-7031F-1297,

5 micron, replaced after each test

Patch Filter - Millipore (housing P/N XX047-00, element P/N LSWP-047-00), 5 micron, inspected and replaced after

each stage

Fluid Samples:

Taken at approximately 0, 6, 15, and 30 hours of each stage

Pump Disassembly and Inspection:

Pretest and after each stage

3.2 HYDRAULIC PUMP TEST STAND MODIFICATIONS

The existing pump test stand at WL/MLBT was designed primarily for testing new and experimental hydraulic fluids using small to medium displacement aircraft hydraulic pumps operating at low flow rates. The PV3-300-7B is a large displacement pump, which would be operated at high flow rates during these tests. To accommodate these flow rates, an increase in power, tubing size, filter capacity and heat exchanger capacity was necessary. The modified test circuit is shown in figure 1. The variable speed drive motor on the existing test stand would supply the additional power needed as it would produce 150 hp versus the approximate 145 hp the pump required at the test plan flow rate of 50 gpm. In order to satisfy the other requirements, major changes to the pump test stand were necessary. The hydraulic circuits of the existing test stand were altered in the following manner:

- a. High pressure flow (pump outlet) To accommodate the higher pressure and flow rate from the pump this circuit was rebuilt using larger tubing size. The throttling valve was modified using an upgrade kit. A circuit was also added to bypass this valve. The relief valve was upgraded and recalibrated. The sensors remained unchanged.
- b. Case drain flow What had been the main return hydraulic circuit was modified to serve as the new case drain circuit. The same heat exchanger, filter assembly, flow meter and other sensors were utilized. Several valves and additional sensors were also incorporated into this circuit for temperature-pressure indication and control.
- c. Main return flow (pump inlet) An entirely new circuit was designed and fabricated. Downstream of the throttle valve the new main return flow was split into two similar circuits. The flow through these circuits passed through individual heat exchangers and filters before being rejoined. Also, at this junction the flow from the heat exchanger bypass circuit was added with the combined flow subsequently passing through a new high capacity flow meter. Case drain flow and any needed make-up fluid from the reservoir were then added to the return flow. Further downstream were several sensors and a sampling valve before connection to the pump inlet.

To accomplish these changes and other necessary modifications to the test stand, the following major items were designed, fabricated, purchased or otherwise obtained:

- a. A new pump mounting flange and drive spline were designed and fabricated with the help of necessary installation drawings furnished by Vickers Corporation.
- b. New hydraulic fittings which mate with the pump inlet-outlet and which also use the same spring energized seals as on the aircraft were designed and fabricated. An adapter was purchased for the Rosan fitting on the pump case drain.
 - c. New throttle valve parts were purchased to upgrade this valve.
- d. Two large (3' long x 8" diameter) heat exchangers were purchased. The large size heat exchangers were needed for the 180 °F inlet temperature requirement for Stage I.
- e. Two large capacity filter assemblies including elements were graciously provided by Pall Corporation.
- f. A new high capacity cooling system recirculating pump, associated fittings and hoses were purchased. Modification to the cooling systems reservoir was also made to accommodate this new pump.

After all these changes were accomplished, the test stand required approximately 8 gallons of test fluid to fill, the majority of it being in the heat exchangers and filters. During operation, approximately 7 gallons of fluid circulated. A schematic of the entire B-1 hydraulic pump test circuit is shown in Figure 2.

3.3 PUMP TESTS

The WL/MLBT hydraulic pump test stand is computer controlled with automatic shutdown interlocks. Data obtained during testing is presented digitally and simultaneously recorded on strip charts.

During these tests, pump stand start up was accomplished in the following manner. After proper pump test stand preparation, the pump depressurizing circuit was energized which allowed the drive motor and the pump speed to be increased at lower pump outlet pressures. After a few seconds and at around 5000 rpm, this circuit was de-energized allowing the outlet pressure to increase to normal levels. The speed was then increased to 5250 rpm, followed by a gradual increase of the output flow from the startup value of 3 gpm to 50 gpm. The pump inlet temperature was maintained at the desired value and the test continued for the entire 30 hour stage duration.

3.3.1 PUMP TESTS 33 AND 34

The MIL-H-5606F testing was conducted as outlined in Section II except that the pretest pump disassembly and inspection before the start of Stage I was not conducted. This pump was installed on the test stand in order to verify proper operation of the modified test stand. During this verification process, and filling the stand with fresh MIL-H-5606F, approximately 12 operating hours were accumulated on the pump, of which very few were at high flow rates or at high fluid temperature. It was then decided to continue using this pump for Test 33 without removing it from the stand for pretest inspection. During inspection after Stage I completion, a slight anomaly was observed on the rubbing surfaces of the piston shoes - radial erosion lines across the shoe faces. Unfortunately, since there was no pump inspection before the beginning of Stage I there is no way to determine if these lines were generated during pump stand operation verification, Stage I testing or were there to begin with. This condition did not seem to affect the performance of the pump. The subsequent pump inspections after Stage II and III revealed little or no change in the appearance of these lines. With the exception of these radial lines, the disassembly and inspection of the pump after each stage completion showed only slight polishing wear with no signs

of loose material or debris. No evidence of cavitation on any pump parts was observed. Overall, the pump and the test fluid performed well during this test. No adjustments were made to the pump compensator before or during this test. Inspection of the patch filter after each stage completion revealed nothing unusual. No significant leaks were observed from the test stand. A total of about 500 ml of fluid leaked from the pump shaft seal. After completion of this test the great majority of the fluid was drained from the tubing, filter assemblies, reservoir and heat exchangers. Some of the tubing, the filter bowls and both large heat exchangers were removed from the stand and drained. The heat exchangers were partially disassembled to facilitate the draining process.

Pump Test 34 with MIL-H-87257 fluid was also conducted as outlined in Section II. Again, the pump and test fluid performed well. There were no discrepancies observed during pump inspections which were conducted after the completion of each stage. There were no signs of any loose material or debris, and only some slight polishing wear was observed on most rubbing surfaces. No evidence of cavitation on any pump part was observed. No adjustments were made to the pump compensator before or during this test. Inspection of the patch filter revealed nothing unusual. No significant leaks were observed from the test stand. A total of 115 ml of fluid leaked from the pump shaft seal.

Photographs of all critical pump parts and surfaces were taken during the pump inspections. These photos are presented in Appendix A and B. Detailed video movies were made during each disassembly and inspection, and are available for loan from WL/MLBT (point of contact: Shashi K. Sharma, at (937) 255-9029).

The pump case drain flow rates were observed and recorded during both pump tests. A comparison plot of the data is shown in Figure 3. It is interesting to note the case drain flow rates for the MIL-H-5606F fluid start out lower, but end up at a higher rate when compared to the flow rates for MIL-H-87257 fluid. This is attributed to the loss of viscosity of MIL-H-5606 with time due to its shear instability, discussed later.

The bleeding of air from the test stand was more difficult in the case of MIL-H-5606 as it seemed to retain more air than MIL-H-87257.

3.4 ANALYSIS OF FLUID SAMPLES

During the pump tests, fluid samples were extracted from the operating test stand as the testing progressed. These samples were taken at the approximate intervals listed in Section II. A number of different analyses were conducted on these samples.

The viscosities of the fluid samples taken were determined at 40 °C and 100 °C. These viscosities are compared in Figure 4. It is easily seen that MIL-H-5606F suffered significant viscosity losses during the first 30 hours of pump testing, whereas the viscosity of MIL-H-87257 was very stable throughout the test. The viscosity index (VI) improvers used to boost the viscosity of MIL-H-5606, break-up under the high shear environment inside the pump, causing a permanent loss of the fluid viscosity. Under the high pressure and high shear rate environment, the VI improved fluids behave more like the base oil (Reference 1).

Water content and acid numbers of the fluid samples were determined and are shown in Table 1.

Trace metal analysis was also performed on these fluid samples. The samples were analyzed for 19 elements including Fe, Ag, Cr, Cu, Mg, Na, Ni, Pb, Si, Sn, Ti, B, Ba, Cd, Mn, Mo, V, and Z. Only those elements which show concentrations above 0.1 ppm. are reported in Table 2.

Samples taken at the end of each stage of testing and the fresh samples of each of the test fluids were evaluated for lubricity. These evaluations were accomplished by 4-ball wear testing method (ASTM D-

4172). The results of the lubricity tests are shown in Figure 5. Clearly, these data indicate better lubricity for MIL-H-87257 when compared to MIL-H-5606F.

4.0 CONCLUSIONS

- 4.1 MIL-H-5606 and MIL-H-87257 hydraulic fluids were successfully pump tested in B-1 aircraft hydraulic pumps under identical conditions. Both pumps showed only slight polishing wear with the exception of the appearance of radial lines on the piston shoe faces of the pump tested with MIL-H-5606. It could not be concluded whether these lines appeared during the testing, or existed prior to the test. However, these lines did not seem to affect the functioning of the pump, and also did not grow in size during the test. No cavitation on any pump parts was observed for both tests.
- 4.2 MIL-H-87257 exhibited better lubricity than MIL-H-5606, as determined by the ASTM D-4172 four-ball wear tests.
- 4.3 Viscosity of MIL-H-5606 reduced by 50% during the first 30 hours of testing.
- 4.4 MIL-H-5606 seems to retain more air than MIL-H-87257.
- 4.5 MIL-H-87257 has exhibited equivalent or better performance than MIL-H-5606 in the B-1 hydraulic pump tests.

5.0 REFERENCES

1. Sharma, S.K. and Forster, N.H., and Gschwender, L.J., "Effect of Viscosity Index Improvers on the Elastohydrodynamic Lubrication Characteristics of a Chlorotrifluoroethylene and a Polyalphaolefin Fluid," Tribology Transactions, vol. 36, no. 3, pp 555-564, Oct 1993

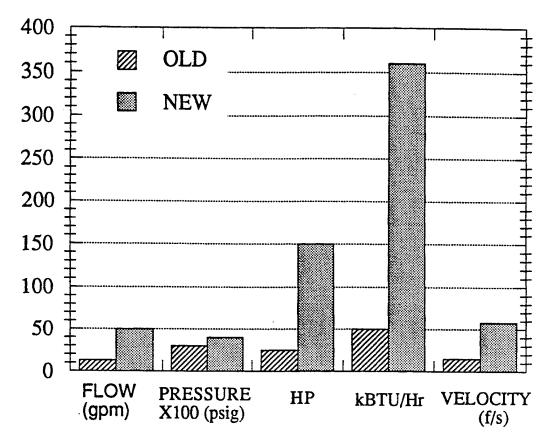
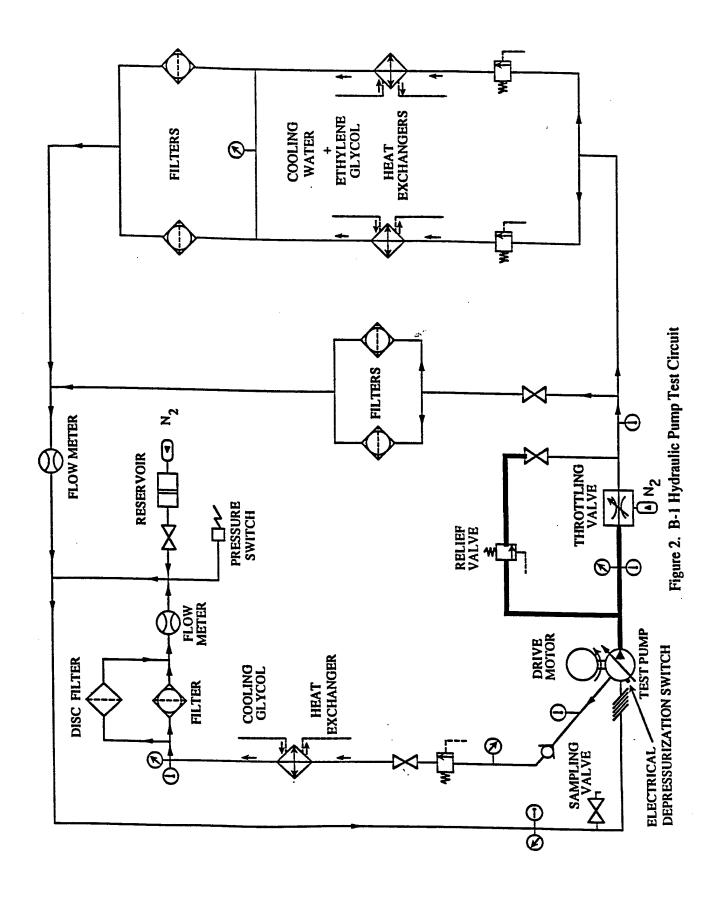


Figure 1. Hydraulic Pump Test Stand Configurations



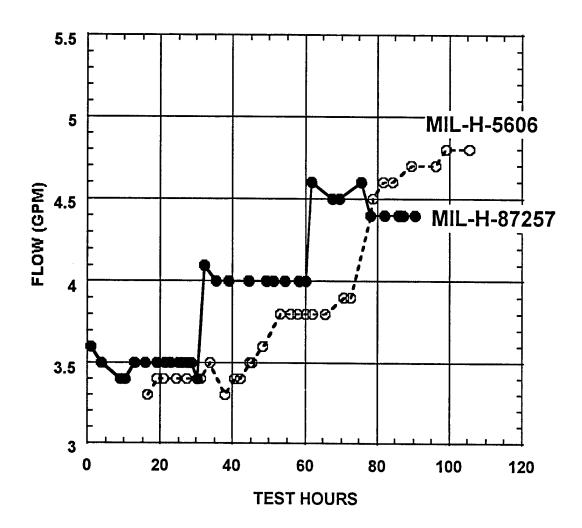


Figure 3. Case drain flow in B-1 pump tests

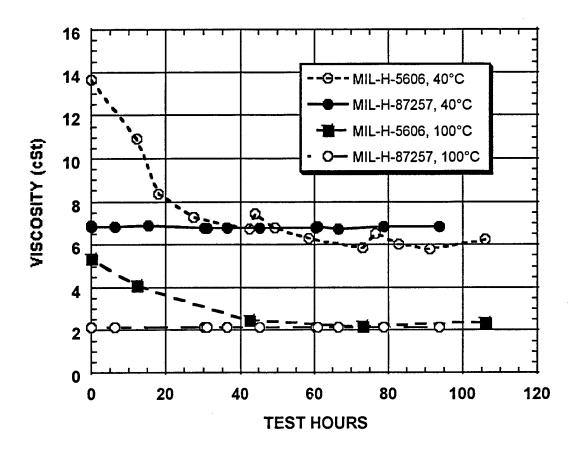


Figure 4. Viscosity change in B-1 pump tests

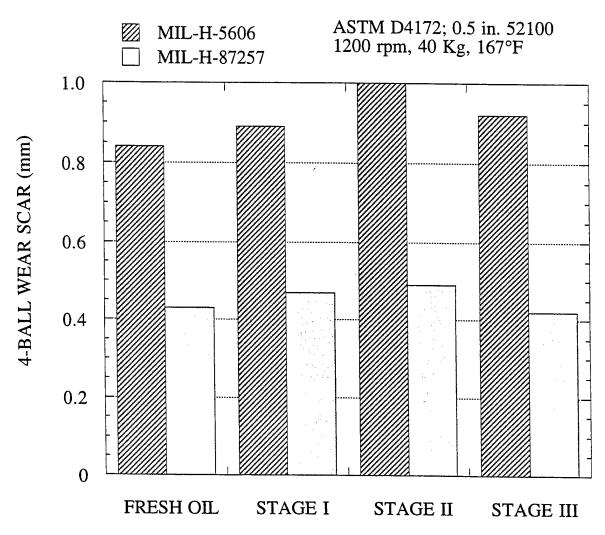


Figure 5. Four-Ball Wear Scar with B-1 Pump Test Fluid Samples

7.0 TABLES

TABLE 1. WATER CONTENT AND ACID NUMBERS OF MIL-H-5606F

SAMPLE NUMBER	TOTAL HOURS	STAGE HOURS	WATER (ppm)	ACID NO. (mgKOH/gm)
STAGE-I			,	
FRESH FLUID	0.0	0.0	56	0.00
MLO 93-1	12.2	0.2	55	0.00
MLO 93-2	18.0	6.0	57	•
MLO 93-3	27.5	15.5	*	•
MLO 93-4	42.5	30.0	94	0.00
STAGE-II				
MLO 93-5	44.2	1.0	89	0.00
MLO 93-6	49.5	6.3	*	•
MLO 93-7	58.3	15.1	*	*
MLO 93-8	73.2	30.0	116	0.08
STAGE-III				
MLO 93-9	76.6	0.2	92	0.00
MLO 93-10	82.7	6.0	•	•
MLO 93-11	91.4	15.0	*	*
MLO 93-12	106.0	29.6	90	0.00
MLO 93-13 (case line)	106.0	29.6	116	0.00
MLO 93-14 (pump case)	106.0	29.6	97	*

^{*} data not determined

WATER CONTENT AND ACID NUMBERS OF MIL-H-87257

SAMPLE NUMBE	ER 5	TOTAL HOURS	STAGE HOURS	WATER (ppm)	ACID NO. (mgKOH/gm)
STAGE-I					
FRESH FLU	IID	0.0	0.0	85	0.04
MLO 93-66	3	0.1	0.1 . ^	127	0.00
MLO 93-15	5	6.1	6.1	172	•
MLO 93-16	3	15.3	15.3	169	•
MLO 93-67	7	30.3	30.3	168	*
STAGE-II					
MLO 93-68	3	30.8	0.5	166	0.00
MLO 93-69	9	36.3	6.0	*	*
MLO 93-70)	45.4	15.1	•	*
MLO 93-7	1	60.3	30.0	173	0.00
STAGE-III					
MLO 93-72	2	60.9	0.6	165	0.00
MLO 93-73	3	66.7	6.0	*	*
MLO 93-74	4	78.8	15.0	*	•
MLO 93-7	5	93.8	30.0	154	0.00

^{*} data not determined

Table 2. Trace Metal Analysis of Pump Test Fluid Samples

Test 33 with MIL-H-5606F

Sample Number	Total Hours	Stage Hours	Fe (ppm)	Ba (ppm)
Stage I				
MLO 93-1	12.2	0.2	0.00	1.7
MLO 93-2	18.0	6.0	0.12	1.9
MLO 93-3	27.5	15.5	0.16	1.9
MLO 93-4	42.5	30.0	0.26	2.0
Stage II				
MLO 93-5	44.2	1.0	0.22	1.5
MLO 93-6	49.5	6.3	0.26	1.7
MLO 93-7	58.3	15.1	0.31	1.8
MLO 93-8	73.2	30.0	0.39	1.8
Stage III				
MLO 93-9	76.6	0.2	0.27	1.5
MLO 93-10	82.7	6.0	0.32	1.5
MLO 93-11	91.4	15.0	0.33	1.6
MLO 93-12	106.0	29.6	0.35	1.5
MLO 93-13 (case line)	106.0	29.6	0.41	1.5
MLO 93-14 (pump case)	106.0	29.6	0.49	1.6

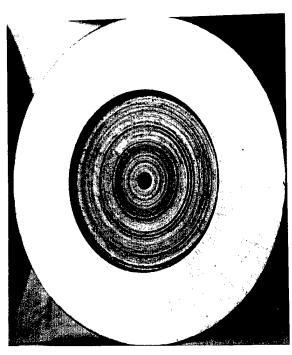
Test 34 with MIL-H-87257

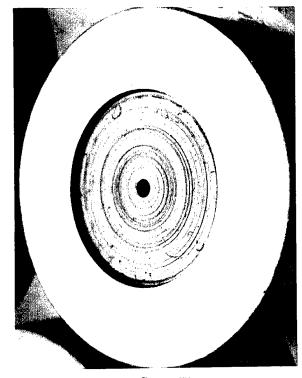
Sample Number	Total Hours	Stage Hours	Fe (ppm)	Ba (ppm)
Stage I				
MLO 93-66	0.1	0.1	0.13	3.1
MLO 93-15	6.1	6.1	0.02	2.4
MLO 93-16	15.3	15.3	0.04	2.3
MLO 93-67	30.3	30.3	0.05	2.3
Stage II				
MLO 93-68	30.8	0.5	0.04	2.3
MLO 93-69	36.3	6.0	0.05	2.2
MLO 93-70	45.4	15.1	0.05	2.2
MLO 93-71	60.3	30.0	0.06	2.1
Stage III				
MLO 93-72	60.9	0.6	0.07	2.1
MLO 93-73	66.7	6.0	0.07	1.9
MLO 93-74	78.8	15.0	0.06	1.9
MLO 93-75	93.8	30.0	0.08	1.6

Appendix A

Inspection Photographs from

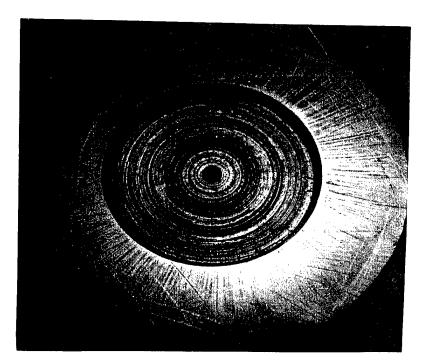
Pump Test 33, MIL-H-5606F





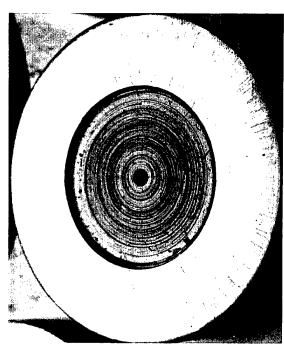
Stage I

Stage II

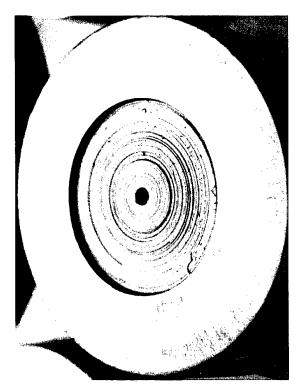


Stage III

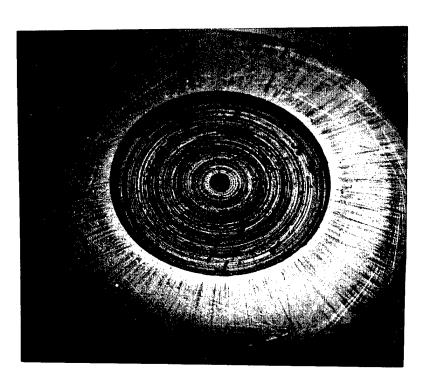
Piston 1 Shoe Face After Stages I, II, and III Pump Test 33 with MIL-H-5606F



Stage I

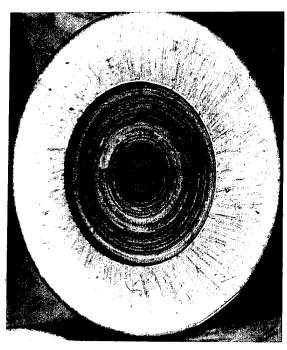


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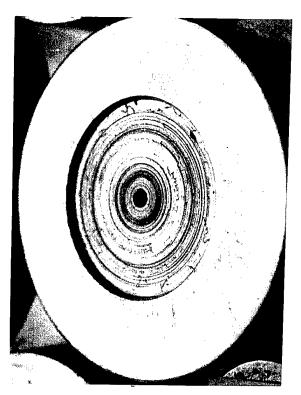


Stage III

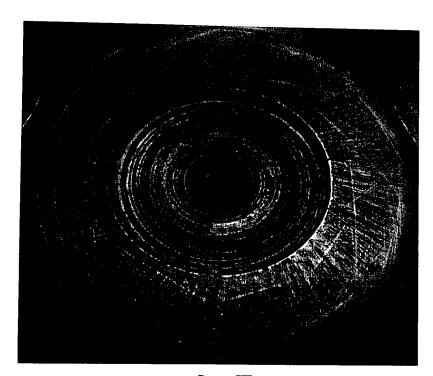
Piston 2 Shoe Face After Stages I, II, and III Pump Test 33 with MIL-H-5606F





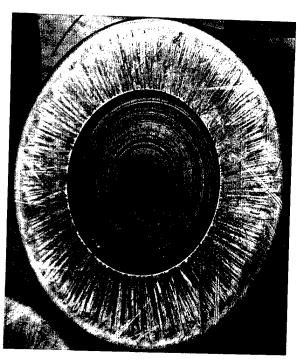


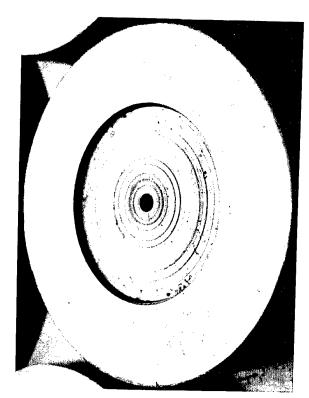
Stage II



Stage III

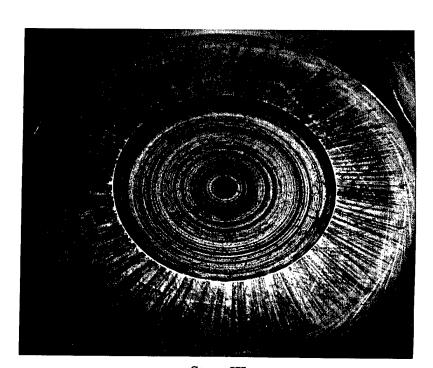
Piston 3 Shoe Face After Stages I, II, and III Pump Test 33 with MIL-H-5606F





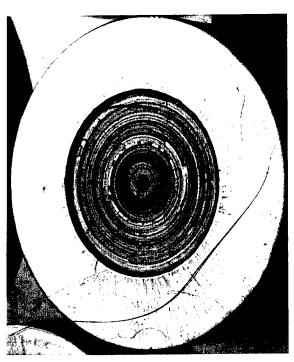
Stage I

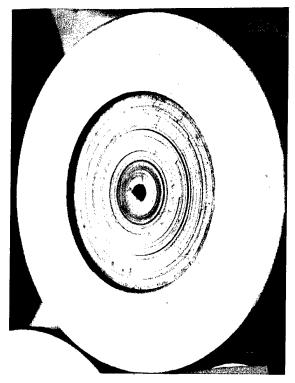
Stage II



Stage III

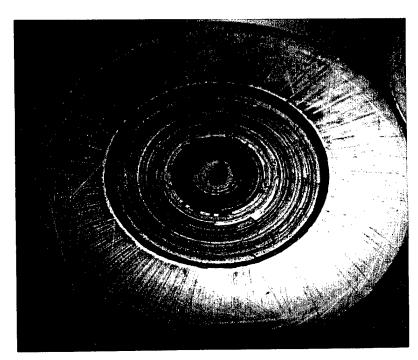
Piston 4 Shoe Face After Stages I, II, and III Pump Test 33 with MIL-H-5606F





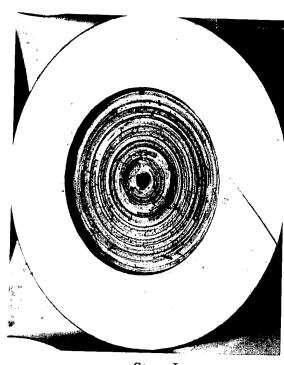
Stage I

Stage II



Stage III

Piston 5 Shoe Face After Stages I, II, and III Pump Test 33 with MIL-H-5606F





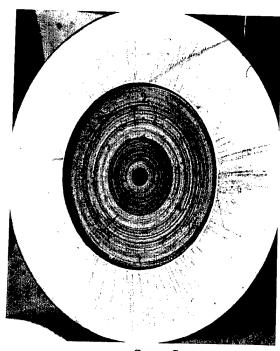
Stage I

Stage II

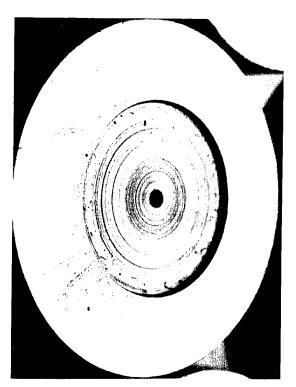


Stage III

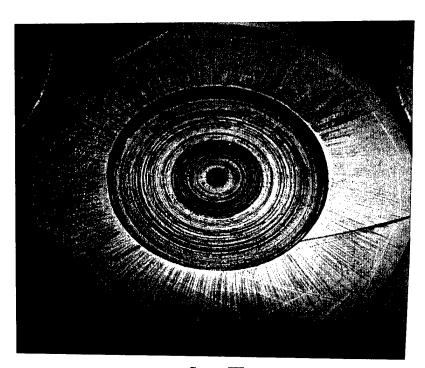
Piston 6 Shoe Face After Stages I, II, and III Pump Test 33 with MIL-H-5606F





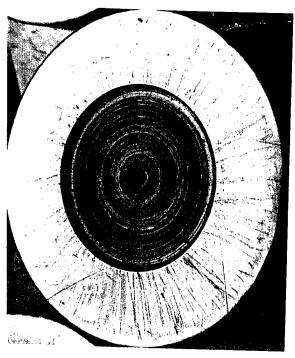


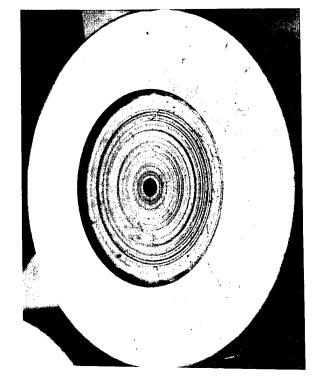
Stage II



Stage III

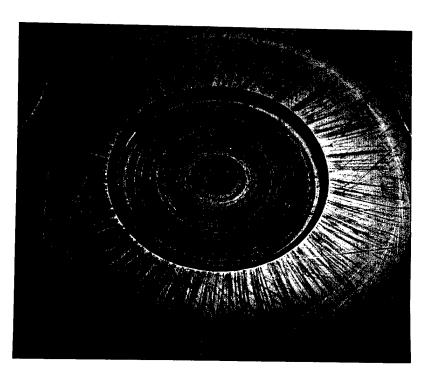
Piston 7 Shoe Face After Stages I, II, and III Pump Test 33 with MIL-H-5606F





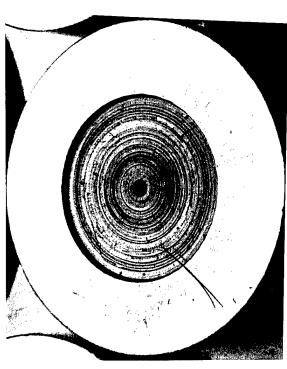
Stage I

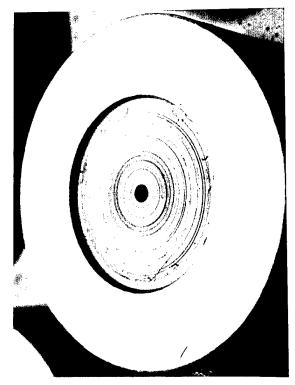
Stage II



Stage III

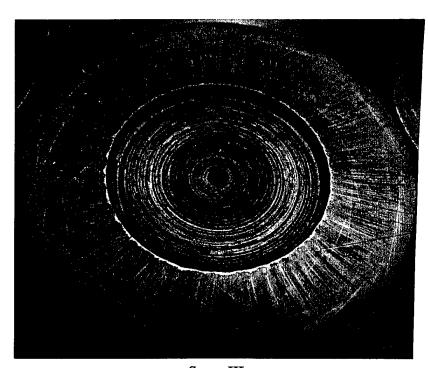
Piston 8 Shoe Face After Stages I, II, and III Pump Test 33 with MIL-H-5606F





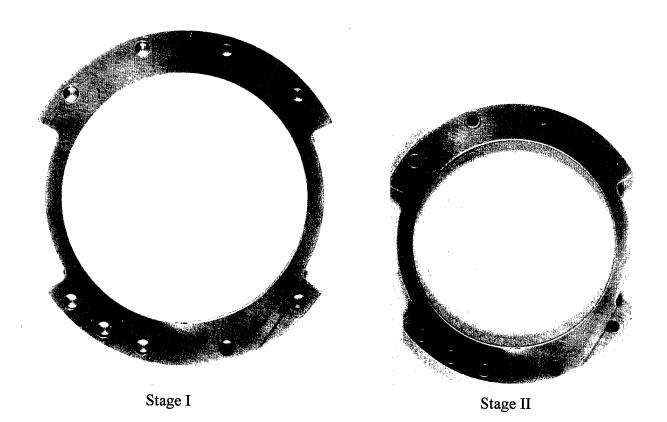
Stage I

Stage II

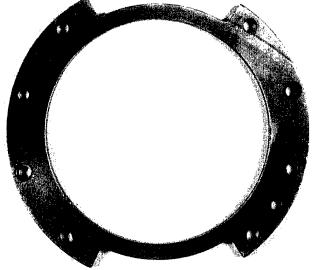


Stage III

Piston 9 Shoe Face After Stages I, II, and III Pump Test 33 with MIL-H-5606F

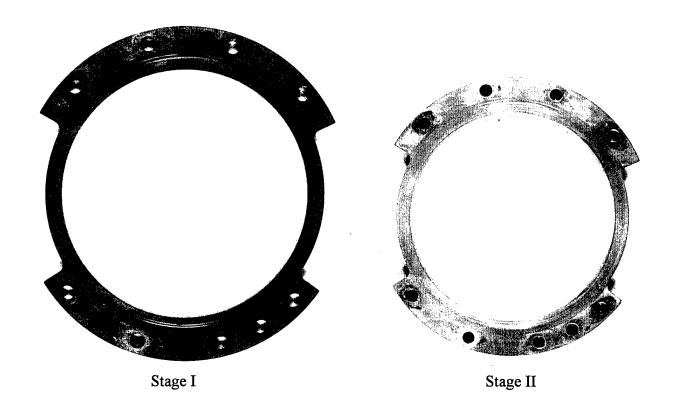


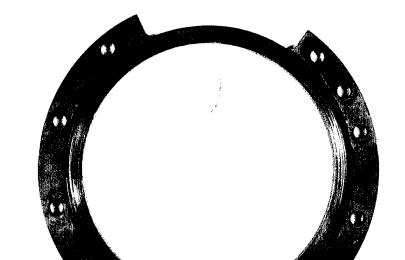




Stage III

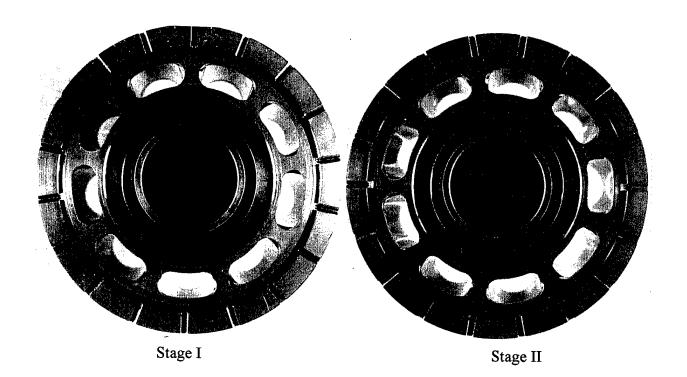
Hold Down Plate - Non Rubbing Side after Stage I, II and III Pump Test 33 with MIL-H-5606F

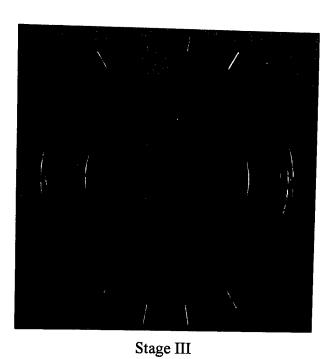




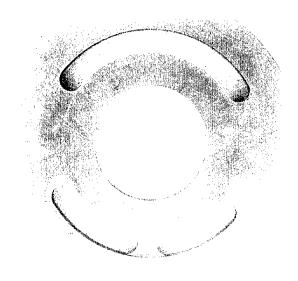
Stage III

Hold Down Plate - Rubbing Side after Stage I, II and III Pump Test 33 with MIL-H-5606F





Cylinder Block Face after Stage I, II and III Pump Test 33 with MIL-H-5606F

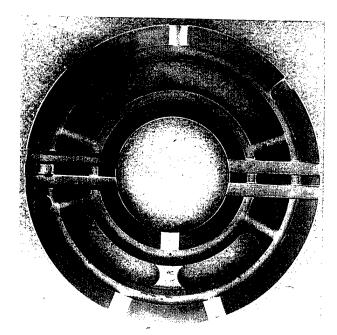


Stage II

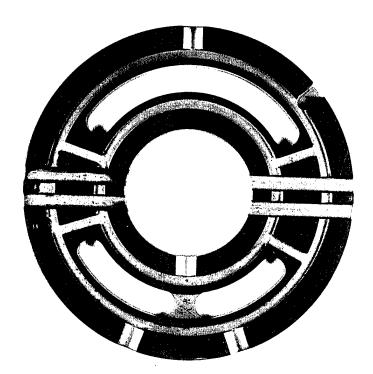


Stage III

Waffle Plate - Rubbing Side after Stage II and III Pump Test 33 with MIL-H-5606F



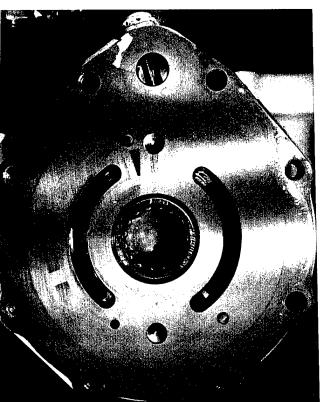
Stage II



Stage III

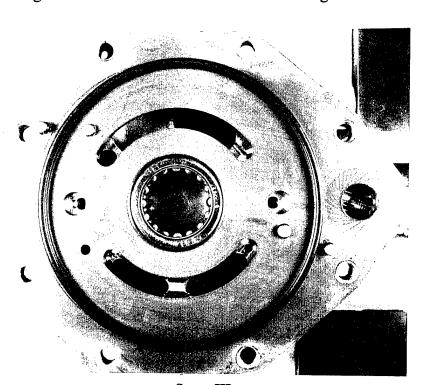
Waffle Plate - Non Rubbing Side after Stage II and III Pump Test 33 with MIL-H-5606F





Stage I

Stage II



Stage III

Cylinder Block Plate after Stage I, II and III Pump Test 33 with MIL-H-5606F



Stage I



Stage II

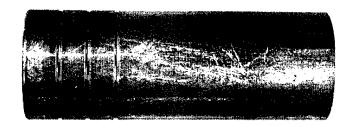


Stage III

Actuator Piston - Front View after Stage I, II and III Pump Test 33 with MIL-H-5606F



Stage II

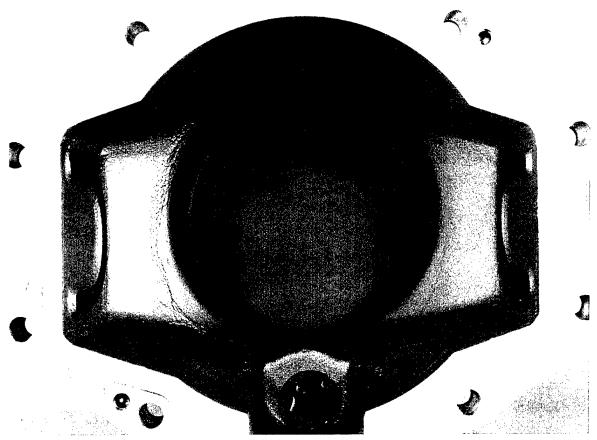


Stage III

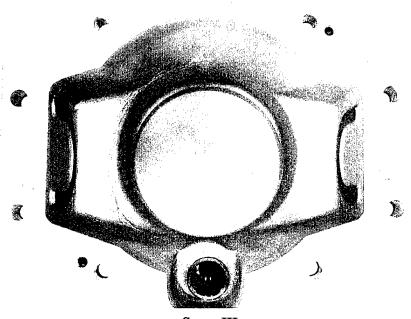
Actuator Piston -Side view after Stage II and III Pump Test 33 with MIL-H-5606F



Housing after Stage I Pump Test 33 with MIL-H-5606F

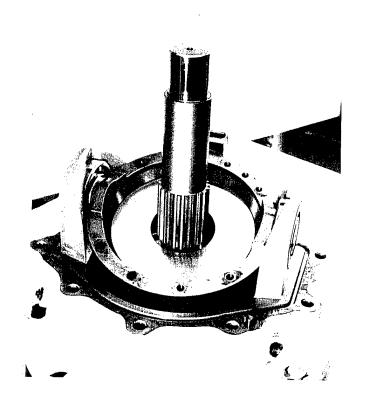


Stage II



Stage III

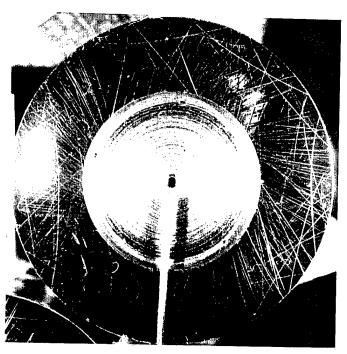
Housing after Stage II and III Pump Test 33 with MIL-H-5606F



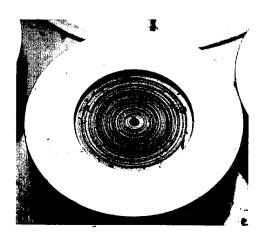
Partial Assembly of Test Pump after Stage II Pump Test 33 with MIL-H-5606F Appendix B

Inspection Photographs from

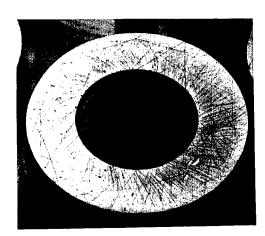
Pump Test 34, MIL-H-87257



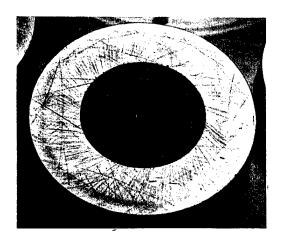
Pretest



Stage I

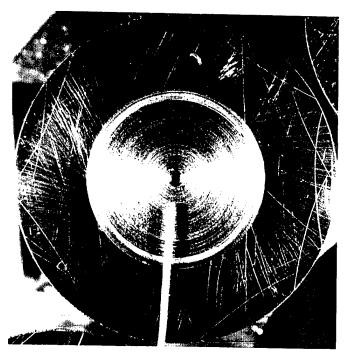


Stage II

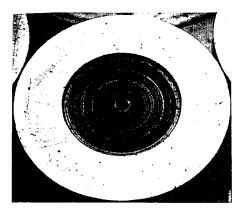


Stage III

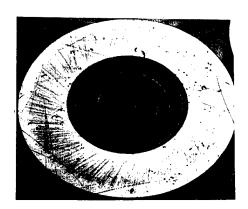
Piston 1 Shoe Face at Pretest, and After Stages I, II, and III
Pump Test 34 with MIL-H-87257



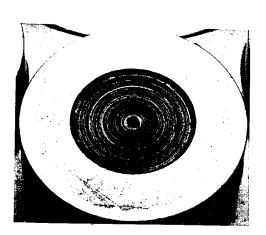
Pretest



Stage I



Stage II

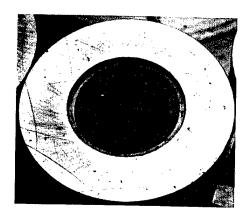


Stage III

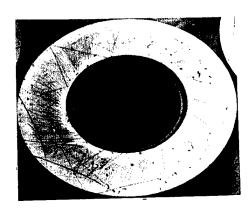
Piston 2 Shoe Face at Pretest, and After Stages I, II, and III
Pump Test 34 with MIL-H-87257



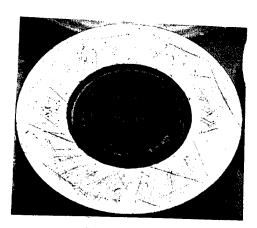
Pretest



Stage I



Stage II

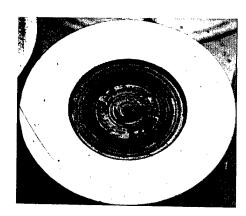


Stage III

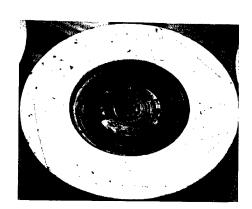
Piston 3 Shoe Face at Pretest, and After Stages I, II, and III
Pump Test 34 with MIL-H-87257



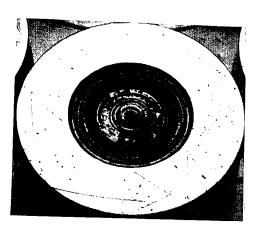
Pretest



Stage I

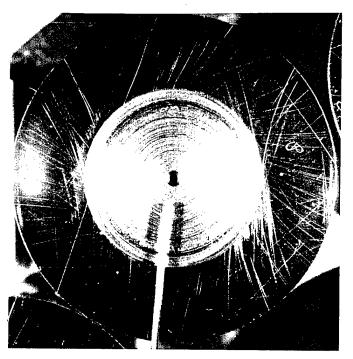


Stage II

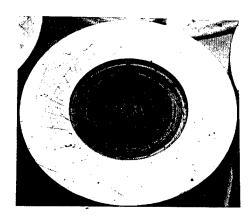


Stage III

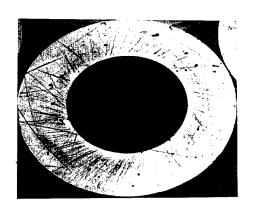
Piston 4 Shoe Face at Pretest, and After Stages I, II, and III
Pump Test 34 with MIL-H-87257



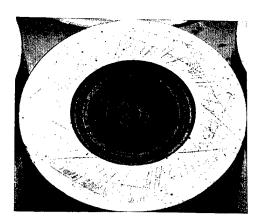
Pretest



Stage I



Stage II

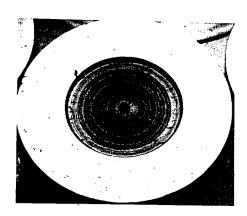


Stage III

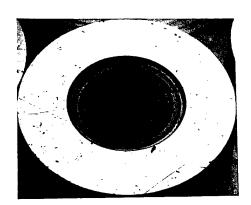
Piston 5 Shoe Face at Pretest, and After Stages I, II, and III
Pump Test 34 with MIL-H-87257



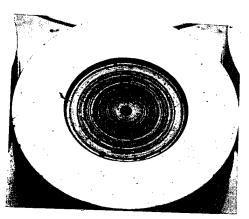
Pretest



Stage I

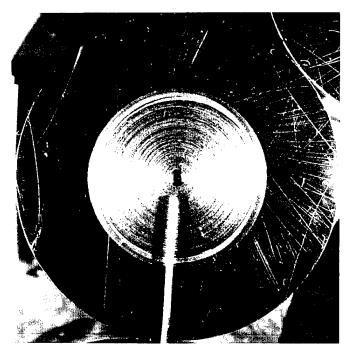


Stage II

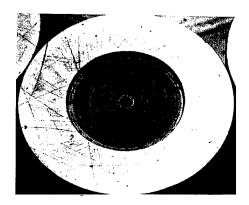


Stage III

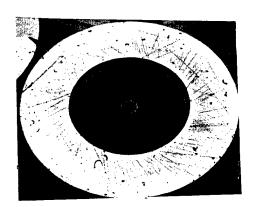
Piston 6 Shoe Face at Pretest, and After Stages I, II, and III
Pump Test 34 with MIL-H-87257



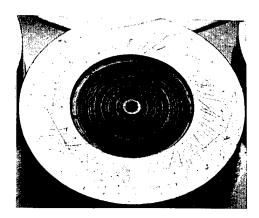
Pretest



Stage I



Stage II



Stage III

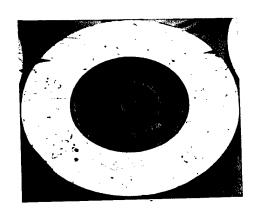
Piston 7 Shoe Face at Pretest, and After Stages I, II, and III
Pump Test 34 with MIL-H-87257



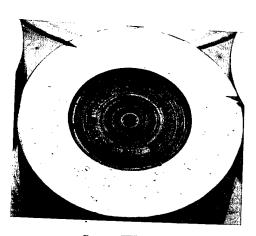
Pretest



Stage I



Stage II

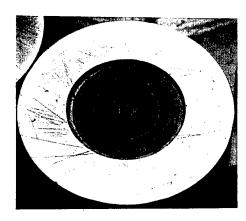


Stage III

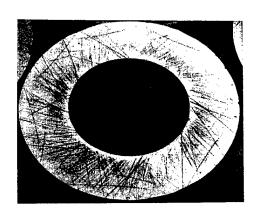
Piston 8 Shoe Face at Pretest, and After Stages I, II, and III
Pump Test 34 with MIL-H-87257



Pretest



Stage I

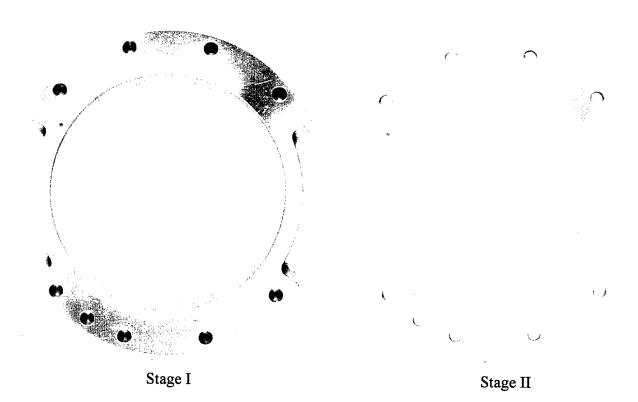


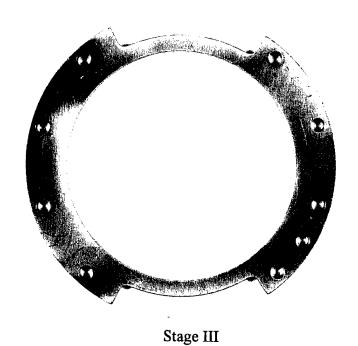
Stage II



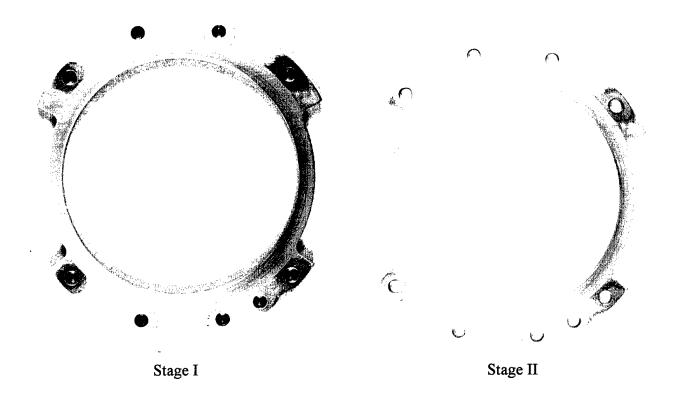
Stage III

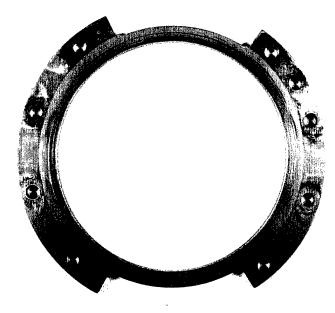
Piston 9 Shoe Face at Pretest, and After Stages I, II, and III Pump Test 34 with MIL-H-87257





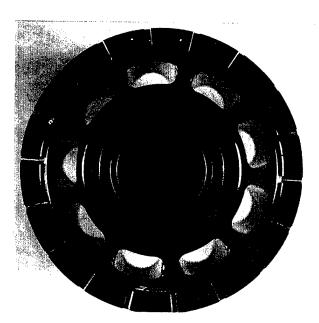
Hold Down Plate - Non Rubbing Side after Stage I, II, and III
Pump Test 34 with MIL-H-87257



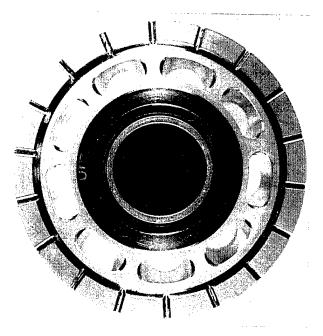


Stage III

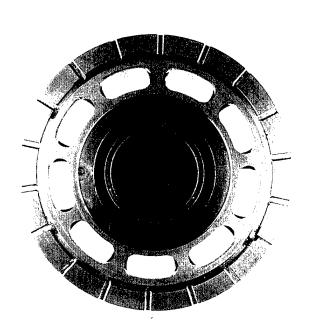
Hold Down Plate - Rubbing Side after Stage I, II, and III
Pump Test 34 with MIL-H-87257



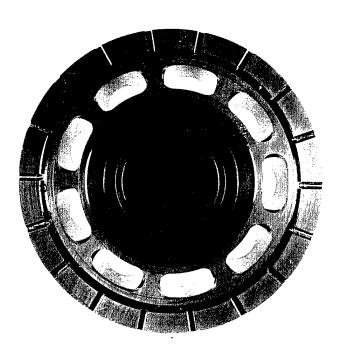
Pretest



Stage I

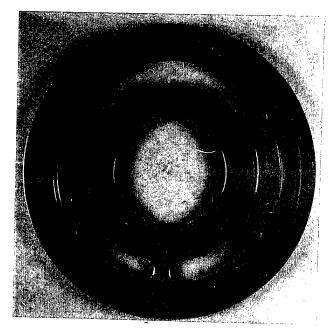


Stage II

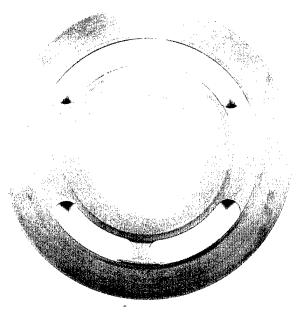


Stage III

Cylinder Block Face at Pretest and after Stage I, II, and III Pump Test 34 with MIL-H-87257

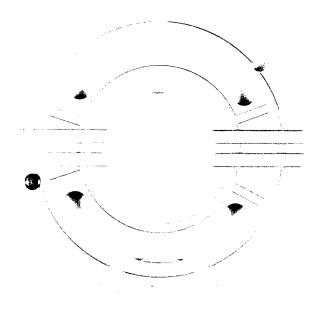


Stage I

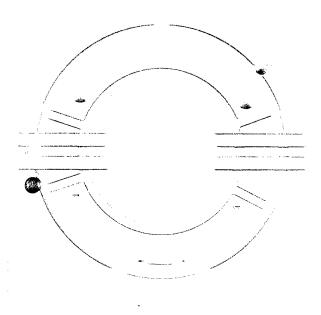


Stage II

Waffle Plate - Rubbing Side after Stage I and II Pump Test 34 with MIL-H-87257

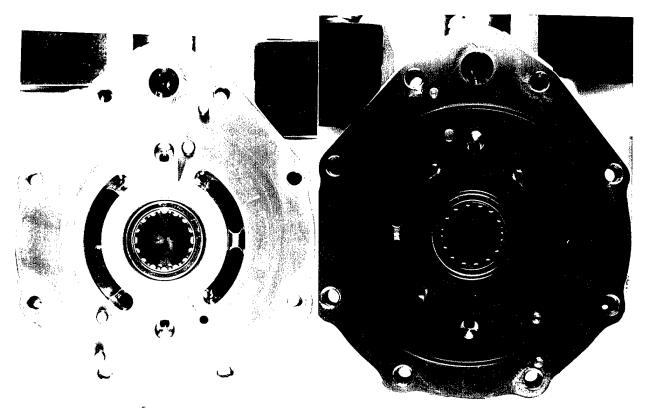


Stage I

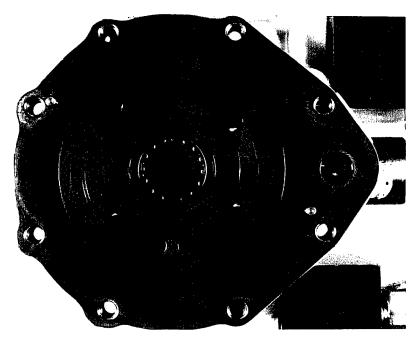


Stage II

Waffle Plate - Non Rubbing Side after Stage I and II Pump Test 34 with MIL-H-87257



Stage II Stage II



Stage III

Cylinder Block Plate after Stage I, II, and III Pump Test 34 with MIL-H-87257



Pretest



Stage I

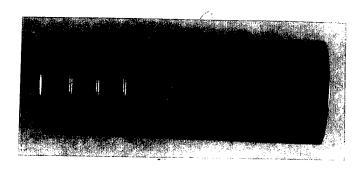


Stage II

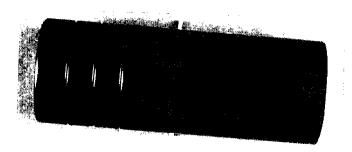


Stage III

Actuator Piston - Front View at Pretest and after Stage I, II, and III
Pump Test 34 with MIL-H-87257



Pretest



Stage I

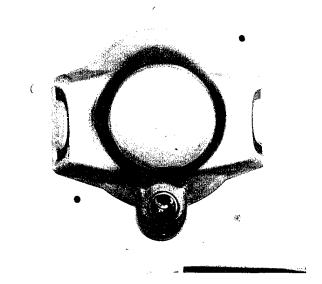


Stage II

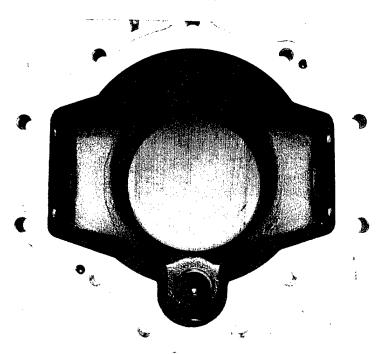


Stage III

Actuator Piston - Side View at Pretest and after Stage I, II, and III Pump Test 34 with MIL-H-87257

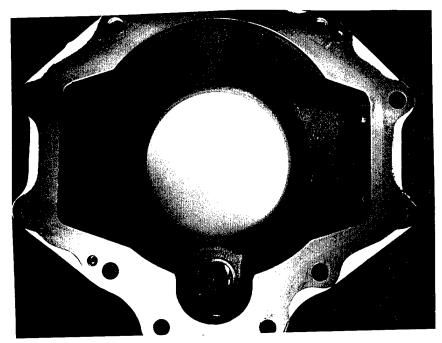


Pretest

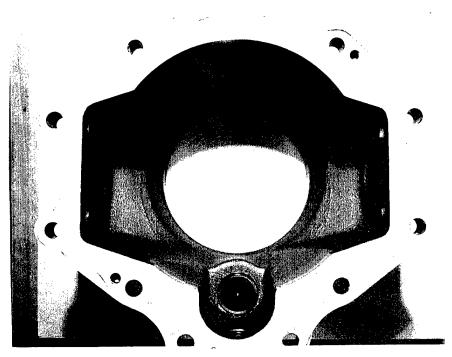


Stage I

Housing at Pretest and after Stage I Pump Test 34 with MIL-H-87257

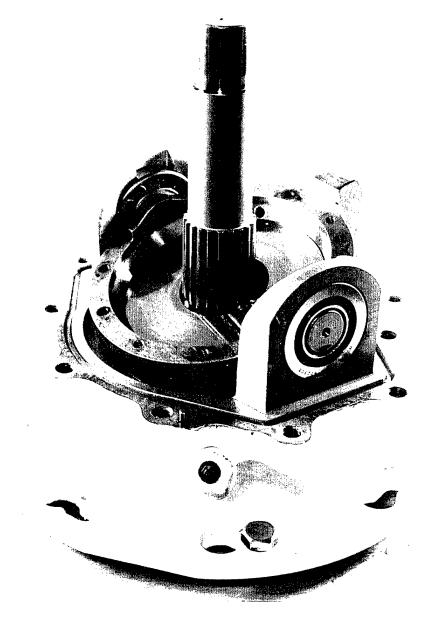


Stage II



Stage III

Housing after Stage II and III Pump Test 34 with MIL-H-87257



Partial Assembly of Test Pump at Pretest Pump Test 34 with MIL-H-87257

Appendix C

Raw Data for Pump Test 33

with MIL-H-5606F

TEST PUMP : MODEL VICKOTS PV3-300-7B S/N : MX 490659B

PUMP TEST DATA FOR ARCRAFT HYDRAULIC FLUID WLMLBT, WPAFB PUMP TEST STAND NO. 1

TEST FLUID: MII-H-5606F MLO 92-144

Total Flow Total Flow Total Speed Total Total Flow Total	A. Throttling Valve Open	Valve	Open Closed								-	,		Motor		Droce	Omu (P	5		Pump fulet	\vdash	Pump Outlet
The control of the	Killing Ed					Total Flow			Total	Spea	<u> </u>	Torq		Motor				 -	1	0.00		Processin
Transport Harm Case Disc Fluval Cannage Case Case			-	Tost		(Gallons)	£	esry.	Seal	(APM	_	jal-ni)		Current	Mar Filta		Case Fille Pall Corp			(pisq)		(psig)
Comment Comm				Hrs. on the	Main	Case		evel.	(ml)	-		-	-	-	: <			U	-	<	8	
1.00				vunter)			7		1	\ <	-	•	+	+		┞		١.				
12.2 1.0		905	6.5	12.0	٥	0			1	+	+	-	+				<u> </u>					
14.7 14.8	6-Jan-93 0	917		12.2				1	\dagger	+	+		+				-					
Fig. 14.7 Fig. 10.808 726 726 7152 164 26 3.6 7.1 4.2 9.2 7.1 752 164 2.5 2.5 3.5 6.9 4.2 9.5 7.1 7.2 7.	6-Jan-93 1	147		14.7			+		1	+	+		+	-	1	-		<u> </u>				
14.9 16.2 10.8	7-Jan-93 0	835	6.5	14.7			+	+	\dagger			+	+	-			_	-			_	
10 10 10 10 10 10 10 10	7-Jan-93 0	850	65	14.9				+			+	012.	†		36	-		-	4	92	4	36
10 10 10 10 10 10 10 10	7-Jan-93 1	025	7.7	16.3	10,808		+	+		5,220	+	76/1		70		-		_		-		
10 10 10 10 15 15 15 15	7-Jan-93 1	205	80	18.0				-		000		1750		63	26	-	3.6	17	5	93	4	37
72 21.0 24.0 1.524 1.724 163 25 9.9 6.9	7-Jan-93 1	305	80	19.0	18,953	١		31.56		2276		200		2 5	2.5	-	3.5	6.8	4	94	4	37
71 24.3 34.914 2.322 131.30 3.224 17.55 16.3 25 4.1 6.9 6.9 6.9 6.0 4.2 6.9 6.9 6.0 4.2 6.0		505	7.2	21.0	24,956	- 1		31.56		022.5	+	1734		63	25	-	3.8	68	5	9.2	4	40
69 27.5 44.745 2.966 19130 5.220 1752 163 25 4.1 69 5 95 72 31.2 55.429 3.736 131.40 5.219 1752 162 25 4.2 68 5 95 72 33.9 63.681 4.266 131.40 5.210 1743 162 25 4.2 68 5 91 70 38.0 75.629 131.40 5.210 1743 162 25 4.2 68 5 91 80 42.0 91.500 131.37 5.210 1746 162 25 4.2 6 5.5 91 80 42.0 91.500 131.20 5.210 1746 162 25 4.2 6 5.5 91 80 42.1 91.500 131.20 5.210 1746 162 25 4.3 6 5.5 91 80 40.0 <td></td> <td>825</td> <td>7.1</td> <td>24.3</td> <td>34,914</td> <td>2,322</td> <td></td> <td>31.38</td> <td>\dagger</td> <td>7777</td> <td>\dagger</td> <td></td> <td> </td> <td>63</td> <td>3,5</td> <td>-</td> <td>3.9</td> <td>L</td> <td>5</td> <td>96</td> <td>4</td> <td>140</td>		825	7.1	24.3	34,914	2,322		31.38	\dagger	7777	\dagger			63	3,5	-	3.9	L	5	96	4	140
12 12 12 12 12 12 12 12		140	69	27.5	44,745	2,996		31.30	1	5,220	+	247	1	2)		-				_	_	
73 31.2 55,429 3,736 111,40 5,219 1722 162 25 4.2 68 5 9 72 31.6 63,681 4,296 131,40 5,206 1732 162 25 4.2 68 5 91 73 36.6 5,206 131,40 5,210 1750 162 25 4.3 69 5.5 91 80 42.0 87,500 5,210 1750 162 25 4.3 69 5.5 91 4.2.0 87,500 131,37 5,210 1746 162 25 4.3 69 5.5 91 4.2.1 80,424 6,012 131,30 5,210 1746 162 25 4.3 69 5.5 91 4.2.2 80,024 6,012 131,30 5,216 1746 162 25 4.3 69 5.5 91 4.2.2 80,034 6,012 131,30 <td>7-Jan-93 2</td> <td>- 40</td> <td>69</td> <td>27.5</td> <td></td> <td></td> <td>+</td> <td>1</td> <td>1</td> <td>+</td> <td>+</td> <td>1750</td> <td>+</td> <td>100</td> <td>25</td> <td>H</td> <td>-</td> <td>69</td> <td>5</td> <td>9 5</td> <td>4</td> <td>137</td>	7-Jan-93 2	- 40	69	27.5			+	1	1	+	+	1750	+	100	25	H	-	69	5	9 5	4	137
196 197	8-Jan-93 0	115	73	31.2	55,429	3,736		31.40	1	5,218	+	26/	+	200	15		4 2	89	5	93	4	134
36.6 3.0	8-Jan-93 0	400	72	33.9	63,681			31.40		5,219	1	1/36/1			1	-		-			-	
79 366 5,106 131,40 5,208 1743 162 25 4,3 69 5,5 92 80 42.0 87,656 5,210 1750 1750 162 25 4,3 69 5,5 90 80 42.0 87,500 5,908 131,37 5,210 1746 162 25 4,3 69 5,5 90 80 42.0 87,500 5,908 131,37 5,210 1746 162 25 4,3 69 5,5 90 42.4 87,500 5,908 131,37 5,210 1746 162 25 4,3 69 5,5 90 42.5 89,034 6,012 30,000 10,5506 had secumulated Inside of pump mounting flange + overboard flow through sensor. 80 5,210 90 90 90 90 90 90 90 90 90 90 90 90 90 90 90 90 90 90	8-Jan-93 0	648	-	36.6			-	-		+	+	+	\dagger	1		+		-	L		-	
79 380 75.658 5.106 191.40 5.208 1.750 162 25 4.3 69 5.5 90 80 40.5 56.20 191.40 5.210 1.750 162 25 4.3 69 5.5 90 80 40.5 59.08 191.37 5.210 1750 162 25 4.3 69 5.5 90 4.2.6 89.034 6.012 250 1100-200 ml of 500 khad accumulated inside of pump mounting flange + overboard flow through sonsor. 4.2 4.2 8.2 4.1 8.2 4.2 8.2	8-Jan-93 0	705	H	36.6				+			+	072,	 	163	3,5	$\frac{1}{1}$	42	89	2	91	4	132
80 40.5 83,287 5,620 131,40 5,210 1746 162 25 4.3 69 5.5 90 42.0 87,500 5,908 131,37 5,210 1746 162 25 4.3 69 5.5 90 42.5 89,034 6,012 250 100-200 ml of 5606 had eccumulated inside of pump mounting flangs + overboard flow through sensor and the supports 250 ml of 5606 had eccumulated inside of pump mounting flangs + overboard flow through sensor and the supports 250 ml of 5606 had eccumulated inside of pump mounting flangs + overboard flow through sensor and the supports 250 ml of 25 4.0 7.0 7.0 9.0 43.2 44.7 44	8-Jan-93 0	825	7.9	38.0	75,658	5,106		31.40		5,208	+	2 5		16.9	3,5	-	1 6	1		92	4	131
82 42.0 67,500 5,908 131.37 5,210 1745 16.0 12.0 1745 16.0 12.0 1745 17.0 17.	8. Jan-93 1	100	80	40.5	83,287	-	-	31.40		5,210		25		200	3 40		6	1		06	4	30
42.4 Graph (100-20) For its (100-20) <	8-Jan-93 1	220	80	42.0	87,500	İ	-	31.37		5,210	+	446		70	63	+					 	
42.5 89,034 6.012 Which a approx 250 ml of solution in basker started of start of Stage II.) 43.2 44.2 44.7 94.746 6.406 131.50	8-Jan-93 1	245	_	42.4				+						1000		origina	14	verboar	# #0#		nsor.	
43.2 Windown = approxist confidence of the confidence of	8-Jan-93 1	250		42.5	89,034				250	100-200	m 01 550	6 nad acc	пшпате	in and		-	H					
82 44.7 64.76 6.406 131.50 5.215 1730 161 26 4.0 78 7 6 94 82 44.7 94.746 6.406 131.50 220 5.215 1718 160 25 4.0 78 7 92 80 48.1 104,924 7.128 131.50 320 5.216 1708 26 4.0 78 7 92 80 48.1 104,924 131.30 330 5.217 1709 161 25 3.9 75 7 93 80 55.1 131.30 340 5.217 1710 159 24 3.9 75 7 93 80 55.1 131.20 350 5.218 1710 159 24 3.9 75 7 93 80 56.3 131.20 350 5.218 1710 159 24 3.8 78 7 92 <td>28. lan-93</td> <td>445</td> <td></td> <td>43.2</td> <td></td> <td></td> <td></td> <td>1</td> <td></td> <td>which =</td> <td>approx. 2</td> <td>E .</td> <td></td> <td>٦0</td> <td>17</td> <td></td> <td>-</td> <td>-</td> <td></td> <td></td> <td></td> <td></td>	28. lan-93	445		43.2				1		which =	approx. 2	E .		٦0	17		-	-				
82 44,7 94,746 6,406 131.50 270 5,215 1718 160 25 4.0 78 7 92 82 45.5 97,037 6,564 131.50 270 5,216 1708 24 3.9 79 6 91 80 48.1 104,924 7,128 131.50 320 5,216 1708 24 3.9 75 7 94 83 53.1 119,760 8,224 131.30 340 5,217 1733 161 25 3.9 75 7 93 86 57.9 131.20 35.216 1710 159 24 3.8 77 8 8 86 57.9 131.20 350 5,218 1710 159 24 3.8 76 8 9 87 60.0 140,419 9,768 131.20 350 5,215 1721 160 25 3.7 76 8 </td <td>28-Jan-93 1</td> <td>545</td> <td></td> <td>44.2</td> <td></td> <td></td> <td></td> <td></td> <td>1</td> <td>Seal leax</td> <td>3ge collec</td> <td>non mon</td> <td>aker Staffe</td> <td>≱ક</td> <td>5L</td> <td></td> <td>1.7</td> <td>77</td> <td>9</td> <td>94</td> <td>4</td> <td>111</td>	28-Jan-93 1	545		44.2					1	Seal leax	3ge collec	non mon	aker Staffe	≱ક	5L		1.7	77	9	94	4	111
82 45.5 97.037 6,564 131.50 27.0 3.6 21 3.9 79 6 91 80 48.1 104,924 7,128 131.50 320 5,217 1767 163 26 4.0 75 7 94 83 53.1 119,760 8,224 131.30 340 5,217 1710 159 24 3.9 75 7 93 84 56.1 128,843 8,892 131.30 350 5,217 1710 159 24 3.8 77 8 9 85 56.1 128,843 8,892 131.20 350 5,218 1710 159 24 3.8 77 8 9 86 57.9 134,120 9,292 131.20 350 5,218 1709 159 25 3.8 78 78 8 84 60.0 140,419 9,768 131.20 370 5,215	28-Jan-93	615	82	44.7	94,746	- 1	- -	31.50	6	5.213	+	130		90	25	-	0.4	78	7	92	4	901
80 48.1 104,924 7,128 131.50 320 5,217 1767 163 26 4.0 75 7 94 83 53.1 119,760 8,224 131.30 340 5,217 1733 161 25 3.9 75 7 93 82 56.1 128,843 8,892 131.30 350 5,217 1710 159 24 3.8 77 8 8 86 57.9 134,120 9,292 131.20 350 5,218 1710 159 24 3.8 77 8 9 59.5 138,920 131.20 360 5,215 1729 159 25 3.8 78 7 92 84 60.0 140,419 9,768 131.20 370 5,215 1721 160 25 3.7 78 8 9 87 62.0 146419 10,216 131.20 370 5,215	28-Jan-93	700	82		97,037	- 1		31.50	0/2	0,4,0	+	170			24	-	3.9	79	9	9.1	4,	102
83 53.1 119,760 8,224 131,30 330 5,217 1733 161 26 4.0 75 7 94 82 56.1 128,843 8,892 131,30 340 5,217 1710 159 24 3.8 77 8 89 86 57.9 134,120 9,292 131,20 350 5,218 1710 159 24 3.8 77 8 89 59.5 138,920 131,20 360 5,215 1709 159 25 3.8 78 7 92 84 60.0 140,419 9,768 131,20 370 5,215 1721 160 25 3.7 78 8 8 87 62.0 146419 10,216 131;20 370 5,215 1721 160 25 3.7 78 8 9 **Static Reading (Offset) During Stage II **3.0 pst; Before Stage III **2.0 pst; After Stage III **0.0 pst; After Stage III **0.0 pst; A	28-Jan-93	937	8.0		104,924	7,128	-	31.50	320		-		-			-						
83 53.1 119,760 8,224 131.30 340 5,217 1733 161 25 3.9 75 7 8 9 86 56.1 128,843 8,692 131.30 350 5,218 1710 159 24 3.8 77 8 89 86 57.9 134,120 350 5,218 1710 159 24 3.8 77 8 89 59.5 138,920 131,20 360 5,215 1721 160 25 3.8 78 7 9 8 84 60.0 140,419 9,768 131,20 370 5,215 1721 160 25 3.7 78 8 8 87 62.0 146419 10,216 131,20 370 5,215 1721 160 25 3.7 78 8 18 18 18 18 18 18 18 18 18 18 18	28-Jan-93 2	100						18	000	600	+	1767		163	26		4.0	7.5	7	9.4	4,	801
82 56.1 128 843 8,692 131.30 340 3.218 1710 159 24 3.8 77 8 69 86 57.9 134,120 9,292 131.20 350 5,218 1710 159 25 3.8 78 7 92 84 60.0 140,419 9,768 131.20 370 5,215 1721 160 25 3.7 78 8 9 87 62.0 146419 10,216 131.20 370 5,215 1721 160 25 3.7 78 8 9 87 62.0 146419 10,216 131.20 370 5,215 1721 160 25 3.7 78 8 9 **Static Reading (Offset) During Stage Its Stage II = 3.0 pst.; Before Stage III = 2.6 pst.; After Stage III = 0. **Static Reading (Offset) During the Whole Test = -7.0 pst.	29-Jan-93 G	040	83		119,760	8,224		31.30	200	100	\dagger	1252		191	25		3.9	7.5	7	93	4	104
86 57.9 134,120 9,292 131,30 350 3,216 1709 159 25 3,8 7 92 59.5 138,920 131,20 360 5,215 1721 160 25 3,7 76 8 84 60.0 140,419 9,768 131,20 370 5,215 1721 160 25 3,7 76 8 87 62.0 146419 10,216 131,20 5215 1721 160 25 3,7 76 8 93 11 = 0 9.3	29-Jan-93 G	1338	82		128,843	8,892		31.30	200		+	7		5.0	24	-	3.8	77	8	8 8	4	901
58.3 131.20 360 5,215 1709 159 25 3.7 78 7 92 84 60.0 146419 10,216 131.20 370 5,215 1721 160 25 3.7 78 8 93 87 62:0 146419 10,216 131.20 370 5,215 1721 160 25 3.7 78 8 93 Static Reading (Offset) During Stage I& Stage II = 30 pst.; Before Stage III = 2.6 pst.; After Stage III = 0.0 pst.; Before Stage III = 2.6 pst.; After Stage III = 0.0 pst.	29.Jan-93 0	522	9 8		134,120	9,292		31.30	320		+							-		-		
84 60.0 146419 10,216 131.20 360 5,215 1721 160 25 3.7 78 7 92 87 62.0 146419 10,216 131.20 370 5,215 1721 160 25 3.7 78 8 93 87 62.0 146419 10,216 131.20 370 5,215 During Stage I& Stage II = 3.0 pst; Before Stage III = 2.6 pst; After Stage III = 0.0 pst *** Static Reading (Offset) During the Whole Test = 4.0 pst	29-Jan-93 0	550		58.3							+		-	+		\mid		_				
84 60.0 140,419 9,768 131.20 370 5,215 1721 160 25 3.7 78 8 93 87 62.0 146419 10,216 131.20 370 5,215 During Stage I & Stage II = 3.0 pst; Before Stage III = 2.6 pst; After Stage III = 0. Static Reading (Offset) During the Whole Test = -7.0 pst.	29-Jan-93 0	200	-	59.5	138,920		-	1			+	100	 	1	3,	1		78	1	92	4	105
87 62.0 146419 10,216 131.20 370 5,215 1721 1501 20 3.11 721 721 3.0 pst; Before Stage III = 2.6 pst; After Stage III = 0. pst; Before Stage III = 2.6 pst; After Stage III = 0. pst; Before Stage III = 2.6 pst; After Stage III = 0. pst; After Stage III = 0.0 pst; Before Stage III = 2.6 pst; After Stage III = 0.0 pst;	0 00 00	730	8.4	0.09	140.419	89,768	-	31.20	360	5,215	+	2/03		200		+	2 6	2 0		03	4	07
• Static Reading (Offset) : During Stage I & Stage II = 3.0 pst.; Belore Stage II = 2.0 pst., Atter Stage III = 2.0 pst., Atter Stage III = 2.0 pst., Atter Static Reading (Offset) During the Whole Test = 4.0 pst.	29-3411-93		2		146419	_	-	31.20		5,215	\dashv	1721		160	2		1, 5	107	Aho	10000	7	
• Static Reading (Offset) During the Whole Test = -7.0 psi.	29-Jan-93	330		1		j				Static Read	Jing (Offs	et): During	Stage 1 &	Stage I	a.0.0 ps	1.; tseriore	egge m	# 2.0 p	. Alle	egage eggage		į
••• Static Reading (Offset) During the Whole Test = 4.0 pst.									ť	Static Read	ding (Offs	et) During	the Whole	1 10 E	-/.0 psi.							
									:	Static Bear	ding (Offs.	et) During	the Whole	Test	4.0 pst.							

			1	ם			_		TEST DATA FOR AIRCRAFT HYDRAULIC FLUID	FORAIR	CRAFTH	YDRAULI	CFLUID			Mil- H-5606F	
= 0	A= Throttling Valve Open R= Throttling Valve Closed	Open					•	WL/MLBT	, wpafe	PUMP	BI, WPAFB PUMP LEST STAND NO. 1	NO NO	_			MLO 92:144	
	Coolant			중	Flow Rate			1 1	8	ature (F)			Coolant T	I EI-	re (F)		
\simeq	Flow (GPM)		Main	Case	(GPM)	Disk	P ela		Pump Outfet	Case Drain	T- Outlet	-	Heat Exchanger Inlet		Heat Exchanger Outlet	REMARKS	
< <	- B	<	8	<	6	6 0	<	₹		8	A B	٧	8	۷	8		
	\vdash			Γ	12.0 hours on pump for fest stand	mnd uo s	p for test	stand re	refinement	يد						Stage 1 - Test Start.	
	L				-	_		L								Sample Taken (Stage I - 0.2 hrs.)	7
	-					_										Manual Shutdown.	Т
4																Test Restart.	-1
,												-		1		Auto Shutdown @ 14.9 hrs., cause unknown. Test Restart.	Ţ
ı		50.27	7	3.30			180	189		222	209	_	83	104	4		Т
ı	-	_								_						Sample Taken (Stage 1 · 6 hrs.)	٦
1		50.30	-	3.40			180	188		22	509	3	83	104	4		7
1		50 30	-	3.40		_	178	187		220	208	8	84	104	4		7
1	-	49.60		3.40			179	188		220	208	3	8.7	107	7		
i i	-	49.90		3.40			178	187		219	207	8	98	107	7		1
ı	\vdash	-													-	Sample Taken (Stage I - 15.5 hrs.)	J
ì	_	50.20	C	3.50			179	188		220	209		88	109	6		7
i		50.20	-	3.50			179	189		20	208		68	110	0		Т
1	_							-		1				1		Manual Shutdown @ 36.6 - Computer problem.	Т
ı														_		Test Restart	Т
1	_	49.90	6	3.30			178	187		219	207		87	108	8		Т
i i	_	50.1	0	3.40			178	187		219	207		68	109	6		П
1	_	50.10	C	3.40			177	187		219	207		87	108	8		Т
f	_	_														Sample Taken (Stage I - 30 hrs.)	1
1	_		_													Test stopped for inspection after stage I	1
1	-	_														Stage II . Test Start	1
í		_												4		Sample Taken (Stage II - 1 hr.)	٦
1	-	50.20	0	3.50			205	217		244	234	=	122	144	4		П
1	-	49.70	C	3.50			211	220	П	249	239		130	150	0		Т
i	_	49.60	0	3.60			214	22.		252	242		136	155	5		T
ı	_	_												_		Sample Taken (Stage II - 6.3 hrs.)	T
1	_	51.20	0	3.80			202	216		246	236	-	127	147	7		7
1	-	50.10	0	3.80			211	220		249	239	=	134	153	6		7
1	L	49.42	2	3.80			211	220		249	240	-	134	154	4		T
ĺ	-	_								1		_				Sample Taken (Stage II - 15.1 hrs.)	T
1										-						Broken wire repaired - Main flow update	\neg
ı I		49.45	5	3.80		1	508	219	\sqcap	248	238	134	134	153	8		7
		75.04	•	000	_			-		٠,				_	-		

TEST PUMP: MODEL	WODEL		Vickers PV3-300-78	3-300-78											HES.	TEST FLUID:							
	S. N.S	S/N : MX 490659B)659B				_	JUMP TEST	DATAFO	RAINCRA	PUMP TEST DATA FOR AIRCRAFT HYDRAULIC FLUID	ALIC FLUID	_				MII-H-5606F	5606F					
	:						_	M.MLBT, V	VPAFB PL	JMP TES	WLMLBT, WPAFB PUMP TEST STAND NO.	O					MLO 8	MLO 92-144					
A- Throttling Valve Open	g Valve	open :																					
B- Throttling Valve Closed	Valve	Closed										-		-	ľ						ŀ		Ţ
		Test		_	Total Flow			Total	Sp	- Q	Torq	eni	Motor		۵	Pressure Drop (PSI	Op (PSI)			Pump Inlet	_	Pump Outlet	jet T
		3	Test		(Gallons)		Resrv.	Sea	(RPM)	-	(iu-lpt)	_	Current		Main	Cas	Case Filter	<u>ပ</u>	Case	Pressure	<u>-</u>	Pressure	
Date	Time		Ę				Fluid	Leakage					(amps)		Filler 1	Pa	Pall Corp.	Œ	Filer	(Bsig)	4	(DSID)	7
		Œ	(as on the	Main	3	OBC	Level	Ē						:		•		:	_				
			counter)				(mm)		<	8	4	<u>-</u>	4	۲ ه	-	٩	ပ စို	<	<u>m</u>	8 4		8	-
29-Jan-93	1302	98	65.5	65.5 157,108	11,028		131.07	415	5,215		1746		161	2	26	3	7	7 /		90	4,102	05	7
29-Jan-93 1812	1812	8	70.7	70.7 172,598	12,196		130.90	4 80	5,215		1727		161	2	25	6				96	4,109	60	
29-Jan-93 2016	2016	100	72.8	72.8 178,797	12,674		130.90	200	5,212		1726		161	2	24	3.2		75 7		90	4,104	04	
29-Jan-93 2040	2040		73.2										-					4			_	-	-
29-Jan-93 2042	2042		73.2	73.2 179,997	12,768								-	_	_			4			-		Т
17-Feb-93 0905	9060		76.4										_	\dashv	4						-		1
17-Feb-93 0917	0917		76.6											+	_					1	+		1
17-Feb-93 0930	0830		7.97										-	-	-						1	1	Т
17-Feb-93 1006	1006	83	78.3	78.3 193,369	13,854			200	5,230		1734		163	2	23	2	8	85 7		9.4	4,078	78	7
17-Feb-93 1145	1145	8 5	78.9	78.9 195,333	14,028			500	5,230		1731		163	7	23	2	7	8 98		9.1	4,072	72	1
17-Feb-93 1430	1430	8.7	81.6	81.6 203,566	14,762			200	5,240		1721		161	7	22	5,4	4 88	8		93	4,071	71	7
17-Feb-93 1536	1536		82.7										-	4	4					1	$\frac{1}{1}$	$\frac{1}{1}$	7
17-Feb-93 1710	1710	88	84.3	84.3 211,643	15,490			200	5,240		1729	1	161	7	23	2.0				93	4.070	20	1
17-Feb-93 2015	2015	9.1	89.4	227,216	16,906				5,245		1743		162	7	23	4.	92	2		93	4,070	02	T
18-Feb-93 0015	0015		91.4										4	-	-		4				$\frac{1}{1}$		Т
18-Feb-93 0500	0200	6	96.2	96.2 247,478	18,760			200	5,245		1745		162	7	23	0				92	4,069	69	
18-Feb-93 0805	0805	06	99.5	99.2 256,652	19,620				5,240		1728		160	7	23	0.3				9.1	4,065	65	T
18-Feb-93 1422	1422	9.1	105.6	105.6 275,677	21,424				5,240		1725		160	7	22	o O		98 8		94	4,064	64	T
18-Feb-93 1445	1445		106.0	106.0 276,964	21,544								-	4	4		-	-		1	-		1
19-Feb-93 0900	0060		106.0										-		-		_				-	-	7
								•	Charle Do	to die	· Cratic Donding (Office) · During State A State	L good C	A COND			900	200	200	· Affor	- 3.0 nei - Roforo Stado III - 2 6 nei - Aftor Stado III - 0 1 nei	-		

• Static Reading (Offset): During Stage 1 & Stage II = 3.0 psi.; Before Stage III = 2.6 psi.; After Stage III = 0.1 psi.
• Static Reading (Offset) During the Whole Test = -7.0 psi.
• Static Reading (Offset) During the Whole Test = -4.0 psi.

TEST FLUID:	Mil- H-5606F MLO 92-144				REMARKS					Sample Taken (Stage II - 30 hrs.)	Test Stopped for inspection.	Stage III - Test Started	Sample Taken (Stage III - 0.2 hrs.)	Stage III - Test Restarted after unexplained shutdown.		Pump Bybass⋅B := Case temp. @ filter inlet.		Sample Taken (Stage III - 6 hrs.)			Sample Taken (Stage III - 15 hrs.)				Auto Shutdown.	Test #33 Completed.
			(F)	changer	flet	В													,							
			Coolant Temperature (F)	Heat Exchanger	Outlet	٧	151	154	156						203	206	208		208	209		211	213	215		
	CICIO		olant Tem	Heat Exchanger		8																				
	PUMP TEST DATA FOR ARCRAFT HYDRAULIC FLUID WUMLBT, WPAFB PUMP TEST STAND NO. 1		පී	Heat Ex	Inlet	. «	131	134	137						183	187	187		187	187		188	191	195		3)Pump case drain after removing pump.
	STAN			2	Outlet	8																				өтол
	ACPAP TEST			Ĺ	ō	<	236	237	239	L			L		275	284 270 277	277	L	283 270 276	275		282 268 276	283 270 276	278		after c
	OH A⊈		lid Temperature (F	Casa	Orain	8	100	(0	_			L		L	_	1270	283 270		3 2 7 0	282 268	L	2 268	3 270	150		train (
	NTA FO		perah	_		<	246	246	248	L		_	L	L	281	287	283		28	283	L	28	28;	285	_	888
	ST DA		Tem	Pump	Outlet	œ	Ĺ		L	L	L		L		_		_				L	_		L	L	Ę
	AR BT		Field	ď	0	<	217	218	219	L	L				257	259	259	L	256	257	L	258	259	261		J. J.
	PUMP			Pump	Inlet	-					L									L	L		_	L		흔
			L	2	Ξ	<	208	209	210		L				247	249	250		249	249		248	249	251		를
					Disk	•		_																L		at exch.
					L	<	L		_	L								_			L					e, 2)He
78	1		Flow Rate	(GPM)	Case	6		0		L			L	_			0		0					0	_	eturn lin
V3-300-	98		٦			_	3.80	3.90	3.90				L	_	4.40	4.50	4.60		4.60	4.70	_	4.70	4.80	4 80	-	1)Main
Vickers PV3-300-78	MX 490659B				Main	-	1	000	9		-	-			120		2		4	40		ļ ģ	9	2 5		taken :
Š	S S S S S S S S S S S S S S S S S S S	Closed	-	•		-	50.65	49.90	49 90			$\frac{1}{1}$	-	<u> </u>	50 25	50.07	50.12	-	50.14	50.64		50.60	50 00	50 00		amples
HODE	Š	evlave or	Coogni	Flow	(GPM)	8	╁	-	L	-	-	-	-	-		-	-			L			-	-	-	Three samples taken: 1)Main return line, 2)Heat exch. inlet line.
TEST PAIND - MODEL		A= Throttling Valve Open B= Throttling Valve Closed	-		18		65.5	70.7	72 B	2 2	73.2	76.4	76.6	76.7	78.3	78.9	81.6	82.7	84.3	89.4	01.4	96	2 00	105 6	106.0	106.0

Appendix D

Raw Data for Pump Test 34

with MIL-H-87257

Pump Outlet 8 Pressure (Baig) 4185 4183 4184 4183 4182 4184 4194 4192 4184 4193 4190 < Mii-H-87257 (Royco) MLO 92-11, MLO-92-142C Pump Inlet Pressure 8 (bisd) 95 92 91 93 92 92 93 < Pressure Pump Case (Bsd) TEST FLUID Case 8 0 0 0 < < 96 96 96 96 95 96 97 97 97 97 97 96 outlet 96 97 99 Pressure Drop (PSI) Pressure (psl) Case Filter 96 92 94 93 93 92 92 inkat @ Filter 1 Main 일일 2 2 20 20 2 2 2 2 2 2 99 PUMP TEST DATA FOR ARCRAFT HYDRAULIC FLUID WLMLBT, WPAFB PUMP TEST STAND NO. 1 Motor Current (вшрв) 160 160 160 168 160 160 160 160 160 160 164 161 < 8 Torque (in-lbf) 1745 1739 1721 1721 1722 1715 1730 1726 1731 1734 8 Speed (RPM) 5220 5220 5210 5206 5208 5220 5220 5230 5230 5230 5230 5230 5220 5230 20 25 30 Leakage (ml) Total Seal 1798 131.75 2094 131.75 4618 131.56 132.75 132.25 131.94 131.56 131.75 Reary. Fluid Level (EE) 5016 2560 3798 6098 758 4236 5230 5482 156 3 Total Flow (Gallons) 72705 88261 30456 55063 66927 83586 Vickers PV3-300-7B 2387 26111 37175 46175 61416 75741 79354 10885 돌 25.0 26.0 27.2 12.9 15.3 18.8 21.1 22.9 23.1 23.1 28.6 30.2 30.3 4.0 23.3 23.3 (as on the 3.8 6.1 9.0 counter) Tost S/N: MX 490651B A. Throttling Valve Open
B. Throttling Valve Closed
Test
Cell
Cell
Cell
(F) (el 68 77 75 1-Apr-93 0200 1-Apr-93 0500 1-Apr-93 0710 1-Apr-93 0900 1030 2-Apr-93 0834 0844 2-Apr-93 0855 2-Apr-93 1035 2-Apr-93 1136 2-Apr-93 1248 2-Apr-93 1414 2-Apr-93 1547 2-Apr-93 1555 2-Apr-93 1555 0848 14-Apr-93 0912 0920 14-Apr-93 0926 TEST PUMP: MODEL 0943 0955 0945 1338 31-Mar-93 1802 31-Mar-93 2110 1-Apr-93 2300 1-Apr-93 0125 1-Apr-93 0912 31-Mar-93 1400 31-Mar-93 1605 31-Mar-93 2030 31-Mar-93 2100 0937 31-Mar-93 31-Mar-93 25-Mar-93 (25-Mar-93 (25-Mar-93 (2-Apr-93 14-Apr-93 14-Apr-93 31-Mar-93 31-Mar-93

Static Reading (Offset) During the Whole Test = -9.0 psi. Static Reading (Offset) During the Whole Test = -6.0 psi.

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TEST PUMP : MODEL Vickers PV3-300-7B SN: MX 490651B

PUMP TEST DATA FOR ARCRAFT HYDRAULIC FLUID WLMLBIT, WPAFB PUMP TEST STAND NO. 1

Mil- H-87257 (Royco) MLO 92-11, MLO-92-142C

A. Throttling Valve Open B. Throttling Valve Closed

B. Thro	B. Throttling Valve Closed	Closed															
	Coolant			Flow	Flow Rate		_1		FEAT	퇿	Dre (F		ರ	Coolant Temperature (F)	perature	E	
Test	Flow			Ō	(GPM)			Pump	Pump	_	Case	≥	Heat E	Heat Exchanger	Heat E	Heat Exchanger	
Hrs.	(GPM)	2	Main	Case	\$6	Disk	×	Inlet	Outlet	+	Drain	oute et	٤	Inlet	ð	Outlet	REMARKS
		~	8	<		<	6	- -	<	· <u> </u>	: @	8	<	60	<	60	
0.0	\vdash							L	-	-							Stage 1 · Test Start.
0.1		_								L							Sample Taken (Stage I-0.1 hrs.).
0.3										_							Manual Shutdown (Cooling water leak).
0.3	_	_															Test Restart.
1.0	_	49.8		3.6				181	190	219	8	209	83		124		
3.6																	Auto Shutdown (Reason Unknown).
3.6	_	_								_							Test Restart.
3.9	_	49.8		3.5			Ē	181	191	216	9	210	83		126		
6.1																	Sample Taken (Stage 1-6.1 hrs.).
9.0		50.0		3.4			Ī	181	190	216	9	509	83		124		
10.4		50.3		3.4			Ī	181	190	217	7	509	84		123		
11.0	_							_									Auto Shutdown (Operator error while changing warning settings).
11.2		_								L							Tost Restart
12.9		49.9		3.5			Ť	181	180	212	2	509	84		124		
15.3		_															Sample Taken (Stage I-15.3 hrs.).
15.9		50.2		3.5			Ť	181	190	213	3	210	84		124		
18.9		49.8		3.5			-	181	190	212	2	209	84		124		
21.1		49.7		3.5				181	190	212	2	209	84		123		
22.9		49.7		3.5			-	181	190	212	2	209	84		124		
23.1																	Manual Shutdown.
23.1		L															Test Restart.
23.3		_															Auto Shutdown (Reason Unknown).
23.3							ш	Bypass T/C be	-	@ 23.3	hrs. Re	@ 23.3 hrs. Reading from Omega.	Отеда	(Case filter inlet Temp.)	r inlet Te	mp.)	Test Restart.
25.0		49.7		3.5				181	190	_	218	209	83		124		
26.0	_	49.8		3.5			Ĥ	181	190		216	509	83		123		
27.2	_	49.7		3.5			-	181	190		218	209	82		124		
28.6		49.8		3.5			-	80	190		218	209	85		124		
30.2		49.6		3.4	-		٦	179	189	_	216	208	82		122		
30.3	_																Sample Taken (Stage I-30.3 hrs.).
30.3																	Manual Shutdown - Stage I Completed - Pump Inspected.
30.3																	Stage II . Test Start.
30.7											4						Auto Shutdown (Reason Unknown).
30.7										\dashv	\exists						Test Restart.
30.8		4			\dashv	1	1	\dashv		\dashv	$\frac{1}{1}$						Sample Taken (Stage II-30.8 hrs.).
									•	-		447					

At pump case outlet.
 At pump case filer inlet (after case flow heat exchanger; before inlet to case filter).

TEST PUMP : MODEL Vickers PV3-300-7B S/N: MX 490651B

PLAMP TEST DATA FOR ARCRAFT HYDRAULIC FLUID WLANLBT, WPAFB PUMP TEST STAND NO. 1

Mil-H-87257 (Royco) MLO 92-11, MLO-92-142C

A. Throttling Valve Open B. Throttling Valve Closed

B. Throttling Valve Closed	alve Clos	8						ŀ	,	-					400,		_	r	1	ŀ	200
	Test		Total Flow	3		Ego .	Speed	<u> </u>	ordro	_	Motor	_		Pressure Linop (P.S.)	101	ŀ	Т		rump men		3
	<u>ই</u>		(Gallons)		Rosev.		(APM	_	(ju-lb)		Current		<u> </u>	Case Filter	ilter	Case			Pressure	_	Pressure
Date	Temp.	H.			Field	Leakage					ашрз	+	-	Pressure (psi	8		Т		a B B	+	6 <u>8</u> 6
	Œ	(as on the	Mei	3	Level	Ê	•	a	•	α	_	δ Δ	α	- talci	ž.		<u>a</u>	Pressure (psio)	_		- B
240,00	_	3	•	RESE	131 75		5218	+	1730	T	1~	+	┸	93	9.5	10	╁╴	136	1_	╁	1.50
14-Apr-93 1404	04 80	35.4	103369	7310			5218		1712		159	16		9.5	94	0	H	138	9.5	4	4161
14-Apr-93 1455														1		-	-			-	-
14-Apr-93 1730			113726	8134	131.68		5217		1725		160			96	98	+	+	7	96	7	4161
	55 82		1	9404	131.56		5215		1746		161	-		94	96	1	-	44	94	4	4160
15-Apr-93 0000		45.4										4				\dashv	1				
15-Anr-93 0342	42 82		144339	10546	131.44	20	5215		1727		160	17		96	96	-	-	144	9.2	7	4160
45 An. 00 0656			1	1	131 44	50	5215		1726		160	17		96	96	0		144	96	4	4161
15. 40. 00 0055			,	_	131.44	20	5215		1716		160	12		94	94	0		141	94	4	4160
15 Apr 00 4946			,	1	131 44	20	5215		1752		162	17		9.2	96	0		143	9.5	4	4157
15. Apr. 93 1448			t	1	131.41	50	5217		1726		160	17		94	96	H		140	94	4	4159
15. Apr. 09 1455	L	L	Į.															_	_	_	
200		6 63		T					-		\vdash			ļ_		_		_		_	
15-Apr-93 1458	2	00.3		T	1			T			+					\vdash	-			\vdash	-
26-Apr-83 1355	2	P.00		1	1		+	+	+		+			\dagger	T	+	+	T			H
26-Apr-93 1413	13	60.7					1	1	1	1	+	1	1	\dagger	1	\dagger	$\frac{1}{1}$	1	\dagger	\dagger	+
26-Apr-93 1420	20	60.7								+	+	1		1	1	+	+	1		+	+
26-Apr-93 1435	35	6.09					1				+	1				+	+	1		+	
26-Apr-93 1530		85 61.8	181904	13522			5230		1721		162	14		92	83	+	+	1	6	4	412/
26-Apr-93 17	20	63.6		14494							-	1			1	+	+		-	+	1
26-Apr-93 1825		86 64.7	190690		132.38	9	5230		1708		159	14		92	83	╗	+	1	6	4	4119
26-Apr-93 1930	30	62.9		15736							+	+				+	+		+	+	1
26-Apr-93 2025	25	66.7									+					+	+		-	+	+
26-Apr-93 2125	25	67.7		16708	132.19	7.0	5230		1704		159	14		92	93	=	1		92	7	4119
26-Apr-93 2310	10 81		204935	17178	132.17	7.0	5230		1710		160	15		98	98	-	+		9.7	4	4124
27-Apr-93 0018											+	-		1		+	+		1	+	1
27-Apr-93 0040	40	70.8									-	_		1	1	+	+			\dagger	+
27-Apr-93 01	30	71.5			Manua	Shutdown	Fluid ov	erflow thr	Manual Shutdown (Fluid overflow through relief valve in high pressure line)	valve in h	gh pre	ssure line	+			+	+	1	+	1	1
28-Apr-93 0638	38	71.6									+					\dagger	+	1	$\frac{1}{1}$	+	+
28-Apr-93 0702	02	72.0						1			\dashv			1		\dagger	+	1	\dagger	\dagger	$\frac{1}{1}$
28-Apr-93 0704	9	72.0								1	1			+		+	+	1	+	+	+
28. Anr. 93 0823	23	73.3									+			1		7	+			+	
28. Apr-93 1013	13	73.3							-		-	4		-		\dashv	\dashv	- 1	-	-	4
28-Apr-93			Test stopped & restarted several tim	ed & rests	arted seve	ral times.	inlet & ou	utlet T/C f	inlet & outlet T/C flucuating (opening & closing).	S guinedo	closing		ht exce.	Thought excessive vibrations may be the cause.	ations m	8 8	the cau	- 1	(See next page same line)	83 e B	me line).
30-Apr-93 0955	55	74.8									-			1		+	+		+	+	1
30-Apr-93 1006	90	75.0									+					+	+		1		1
30-Apr-93 1012										+	+	-	1	1	7	+	+	1	-	+	-
30-Apr-93 10	1	87 75.7	221105	18574			5230		1712	-	163			9.5	94	9	-	1	92	1	4126
	١								0	4	14.44	40.0									

A Static Reading (Offset) During the Whole Test = -9.0 psi.

TEST PUMP : MODEL Vickers PV3-300-7B SN: MX 490651B

PUMP TEST DATA FOR ARCRAFT HYDRAULIC FLUID WL/MLBT, WPAFB PUMP TEST STAND NO. 1

Mil- H-87257 (Royco) MLO 92-11, MLO-92-142C TEST FLUID:

A. Three	B. Throtting Valve Closed	200																
	Coolan	15			Flow Rate	ate		L		Fluid Te	Temperature (F)	ture (F		L	Coolar	odmot 1r	Coolant Temperature (F)	
Test	Flo	>			(GPM)	1		로	۱۵	Pum	_	Casa	L	┝	Heat Exchanger		Heat Exchanger	
Hrs.	(GPM)	L	Main		Case	H	Disk	2	Inlet	Outlet	-4	Drain	Outte	5	Inlet	-	Outlet	REMARKS
	•	Œ	•	α	_			_	•	_	• •	: =	<				 	
32.1	1	t	4 0 A	+	+	╀	╀	12		١.	۳	1	-	-	136		166	
35.4			49.5		0.4			209		221	247		239	\vdash	134		165	
36.3					_	-				-	-	L		_	_			Sample Taken (Stage II-36.3 hrs.).
38.9		f	49.9	t	0.4	-	L	212		224	250	0	242	-	139		169	
44.3			50.5		4.0	_	_	210		222	248	8	240		134		167	
45.4		\vdash	-		_					_	_							Sample Taken (Stage II-45.4 hrs.).
49.1			49.9		0.4			212		224	250	0	242		139		170	
51.3		-	49.9	\vdash	0.4	_	_	212		224	249	6	242		138		170	
54.3		ľ	49.6	-	0.4		_	212		224	249	6	242		139		170	
58.2		-	50.8		0.4			213		225	250	0	243	_	139		171	
602			0 67	F	0.4	L		211		223	248	8	241	\vdash	137	_	170	
603				I						-	\vdash	L		\vdash		-		Sample Taken (Stage II-60.3 hrs.).
9		-	1	t			-	-		\vdash	H	_						Manual Shutdown - Stage II Completed - Pump Inspected.
80.09		\dagger			-					+	-	-		-			_	Stage III - Test Start.
60.7		\dagger		-	-	-	-			-	-	L		L	_	-		Auto Shutdown (Reason Unknown).
209		-		\vdash	-	-	-			+	-	-		\vdash	_	-		Test Restart.
6.09		\vdash	+	T		-				-	-	_		-	_	_		Sample Taken (Stage III-60.9 hrs.).
61.8		-	49.9	H	4 .6		_	248		259	282	2	276		195		220	
63.6		-	-	T	-	-		_		-	-			H				Bypass flow indication inoperative.
64.7		-	49.8		inop.		_	253		264	287	7 2 7 1	281		203		227	
62.9						_						Ш		Н				Bypass flow indication operative.
66.7		_						Ц			\Box					-		Sample Taken (Stage III-66.7 hrs.).
67.7		<u> </u>	49.7	-	4.5			253		264	287	17 271			203	-	227	
69.5		<u> </u>	49.9		4.5			252		264	286	6 271	280		202		226	
70.8		_	-									_		4		4		Auto Shutdown (Reason Unknown).
70.8		-	-			_					_			4	_			Test Restart.
71.5			-		Manual 5	Shutdow	Manual Shutdown (Fluid overflow through	overflow	v throu	_	of valve	in hig	elief valve in high pressure line)	ure line	_	-		
71.6		-	-		<u>_</u>	-	_			-	L			_				Test Restart.
72.0		-	-		_	-	L			-								Auto Shutdown (Reason Unknown).
72.0		-	-	-	-	_												Test Restart.
73.3		-		H	_	_				_	_							Manual Shutdown (Bad pump inlet temperature T/C).
73.3		-	-		_ 	_				ļ								Test Restart.
		Openec	d bumb	for ins	Opened pump for inspection. Looks good.	Looks g		Fixed both T/C	1/C	leads.								
74.8		-		-	-	_	L			H	Н			Ц				Test Restart.
75.0		-	-	L	_	-	_											Auto Shutdown (Reason Unknown).
75.0		-	-	-		-				-				Н				Test Restart.
75.7		4	49.7		4.6	\Box		249		255	28	282 266 276	576	\dashv	196	-	221	

At pump case outlet.
 At pump case filer inlet (after case flow heat exchanger; before inlet to case filer).

CONT. OF IN CASE		Woken D	Wickers DVP. 200. 7B													TEST FLUID:	ö			
SN:	. t	S/N : MX 490651B					PUMP TE	ST DATA!	PUMP TEST DATA FOR ARCRAFT HYDRAULIC FLUID	ET HYDRAL	ALIC FLU	õ					Mil-H-87	Mil-H-87257 (Royco)	80)	ن
							WALBI	WYA-B	WCMLBI, WPA-BPOMPIESISIAND NO. 1	NY IN	-						MLO 92) I	76.70)
A- Throttling Valve Open	lve Ope	Ē																		
B. Throttling Valve Closed	No Clos	8							,	-			6		400		00.0	, cm.0	H	Dien Cuttot
	Test		Total	Total Flow		E CO	S S	900	Torde	9	Motor		7.05	Pressure Urop (PS)	LSI				_	3
	3	Test	(Gallons)	(900	Resrv.	Seal	(RPM)	=	(jql·uj)		Curent	Main	두	Case Filter	ilter	Case	Case	Pressure	•	Pressure
	Time Temp				Fluid	Leaksoe				_	(sdwa)	Filter	ir 1	Pressure (psi)	(bsi)	Filter	<u>a</u>	(bisd)		(psig)
	ú	5	Neis	3	0.0	Ê			 	 		77				٥	Pressure			
	<u>:</u>	counter)			(EE		<	89	<	. 8	AB	A	В	inlet	outlet	8 ¥	(psig)	<	8	8 V
00. Apr. 00 1930		87 783	228822	19252	19252 133.10	06	5230		1714		091	15		88	90	0		8	7	119
20 400																				
30-Apr-83	1	00 1	00 1 040108	•	20248 133 00	90	5230		1715	_	160	=		96	87	0		96	7	4124
30-Apr-83 17 10			85 8 251977	1	21202 133 00		1		1715	-	160	15		96	9.7	0		8.1	•	4122
30-Apr-93	١		97 2 256030	ı	21800 133 00		1		1720	- 	161	=		8.7	85	0		9.7	7	4122
30-Apr-83 6233			90 4 265405	1	22396 132.94	ľ	1		1737	-	162	15		9.7	8.6	0		97	7	4123
1-May-93 0437			274524	1	23170 132.88	115	5230		1700		160	14		96	97	0	146	96	1	1121
1-May-93 0500	0	93.8								1	+		1	1		+			\dagger	$\frac{1}{1}$
1-May-93 0506	9	83.8	93.9 275877	23286					-		\dashv	1		1	1	4			1	

Δ Static Reading (Offset) During the Whole Test = -9.0 psl.
ΔΔ Static Reading (Offset) During the Whole Test = -6.0 psl.

TEST PUMP: MODEL	WP:MO	ЮЕГ С		Vickers PV3-300-7B	-300-7	œ														TEST FLUID:	
		SVS	X 4	MX 490651B	~							PUMP WL/MI	TEST BT, W	DATA PAFE	FORA	NINCRAFT) P TEST ST	PUMP TEST DATA FOR ARCRAFT HYDRAULIC FLUID WL/MLBT, WPAFB PUMP TEST STAND NO. 1	S FLUID		Mil- H-87257 (Royco) MLO 92-11, MLO-92-142C	
A. Thre	V Gulda	/alve Op	5																		
B. Thre	Vitting V	'alve Clo	peso					:													
	ဒိ	Coolant			윤	Flow Rate	_		L		Fluid Temperature (F)	ed me	ature	Œ) 	Coolant Temperature (F)	perature	<u> </u>		
Test	Flow	*			9	(GPM)			æ	Pump	Pump	ď	Case	_	7	-	Heat Exchanger	Heat Exchanger	changer		
Hrs	ල	£	Mein	Ē	Ö	Case		Disk	Infet	10	Outlet		Drain	_	Oute		Inlet	Outlet	101	REMARKS	
							L	L					<u> </u>	:	_						
	٧	8	٧	8	٨	8	~	8	٧	8	<	8	<	8	8	<	63	<	60		
78.3			50.0		4.4				1251		257		284 270 278	70 2	78	202	2	227			Г
78.8														Н						Sample Taken (Stage III-78.8 hrs.).	Г
82.1			50.2		4.4				251		257	,,,	285 270 279	70 2	19	200	0	224			Π
85.8			50.5		4.4				253		259	7	286 271 281	71 21	81	202	2	226			1
87.3			50.3		4.4				251		257	2	285 270 279	70 2	79	200	0	224			П
90.4			50.8		4.4				253		258	12	286 271 280	71 26	90	202	2	226			Г
93.4			49.7		4.4				251		257	12	285 270 279	70 2,	62	200)(224			Г
93.8												Н	Н	Н	Ц				Ţ	Sample Taken (Stage III-93.8 hrs.).	
93.9														Н					-	Manual Shutdown - Stage III Completed - Pump Inspected.	
											•	!		1							1

* At pump case outlet. ** At pump case filter inlet (after case flow heat exchanger; before inlet to case filter).